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The Armed Forces Chemical Journal is the official publication of the Armed Forces Chemical Association. The fact that an article appears in its columns does not indicate the approval of the views expressed in it by any group or any individual other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors.

COVER PHOTO

General Bullene presents the National Colors and Chemical Corps flag to the Chemical warfare Reserve Mobilization Detachment No. 10. Receiving the Colors is Col. Samuel Cummings. Pictured are Lt. Col. Escude, Col. Cummings, Gen. Bullene, Gen. Porter and Col. Walter A. Guild, First Army Chemical Officer.

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ADVERTISERS

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PRESIDENT'S LETTER TO THE MEMBERSHIP

ANNUAL MEETING—MAY 20-21

The New York Chapter under the leadership of General William N. Porter, with the able assistance of Chairman Eugene McCauliff, Director Sidney D. Kirkpatrick and many others of the New York Chapter, are working closely with our Convention Chairman Howard S. McQuaid in planning the kind of a program that we think you want for your Eighth Annual Meeting.

The convention headquarters—the Waldorf—brings us near a large number of our members in the center of our largest city which holds many attractions for those living elsewhere. The program is being planned to give the out-of-town visitor opportunities to sight-see and go to the theaters, as well as to gain military and industrial information that I know will be most interesting.

At THE JOURNAL'S deadline we do not know for sure who will address you at the banquet but we expect to have a most outstanding speaker. The rest of the program is rapidly being completed and is one that I am sure you will like.

Come and renew your old friendships and meet our newcomers to this group which plays such a vital part in the relationship between the military and chemical industry. We particularly would like to see many of our old Reserve Officers and civilian members of the military at this convention and are looking forward to meeting you there.

Sincerely yours,
L. W. Munchmeyer

NEW YORK CHAPTER WELL ORGANIZED FOR ANNUAL MEETING

Exciting plans are being shaped up for the 1953 Annual Meeting in New York, May 20-21. Selection of the famous Waldorf-Astoria as headquarters is indicative of the character of arrangements and facilities. An equally attractive program will deal with matters of vital interest to all AFCA members whether in industry, education, government or military service.

Committees

Major General William N. Porter (Ret.), former Chief, Chemical Corps, now Chairman of the Board of Chemical Construction Corp., is president of the New York Chapter, AFCA. Eugene McCauliff of Glyco Products will be General Chairman of the Annual Meeting. He is ably supported by the following heads of important subcommittees: Finance, Walter E. Spicer, Jr., Lambert Pharmacal Co.; Operations: (Housing, Registration, etc.), Robert J. Milano, Millmaster Chemical Corp.; Invitations and Attendance, E. L. Van Deusen, *Chemical Week;* Registration, Donald Calo, Niagara Alkali Co.; Hotel and Housing, Howard T. Von Oehsen, Heyden Chemical Corp.; Special Activities, Paul B. Slawter, Jr., Sterling Advertising Agency; Program, Joel Henry, Chemical Construction Corp.; and Publicity, Sidney D. Kirkpatrick, McGraw-Hill Publishing Co.

Special plans for the ladies include a breakfast and interior decorating program in the distinctive Charleston Garden of B. Altman Co. (decorators of the newly remodeled White House), a sightseeing boat trip around Manhattan Island, and a springtime afternoon and evening in Greenwich Village with its sidewalk art exhibits, cafes and nightclubs. Or they can go on a tour of Radio City's TV and broadcasting studios and visit a new ocean liner.

Program

Here are some of the highlights of the program as outlined by Howard S. McQuaid, du Pont Co., national chairman of meetings and conventions:

Wed. 10:00 a.m.—Registration

11:00 a.m.—Directors and Subcommittee meetings

2:00 p.m.—Annual Business Meeting, presidential message to membership, committee reports and discussion

4:30-5:30—Social Hour and Mixer

(Evening open for theatre parties, radio and TV programs, Greenwich Village, etc.)

Thurs. 10.00 a.m.—Chemical Manpower Resources and Reserves

First report and discussion of the work of the AFCA Technical Manpower Commission which is pin-pointing its attack on the Armed Forces Reserve Act passed July 9, 1952. Walter E. Lawson of du Pont, past president of AFCA, is chairman of this important Commission. Other members include Col. L. W. Munchmeyer of General Aniline; Col. Harry A. Kuhn, USA (Ret.), Allied Chem. & Dye; Dr. Donald B. Keyes, NAM and Arthur D. Little, Inc.; Col. O. C. Maier, AAF (Ret.), Pullman-Standard; Major General William N. Porter, USA (Ret.); Major General M. M. Maas, Marine Reserve (Ret.); and Vice Admiral E. W. Mills, USN (Ret.).

Major General William N. Porter, Retiring President of the New York Chapter of the Armed Forces Chemical Association, extends his greetings to all the members of the Association and hopes that he will have the opportunity of personally meeting them at the National Meeting in May.

11:00 a.m. — Speaker to be announced (Probably Hanson W. Baldwin of *New York Times*)

12:30 p.m.—Luncheon

2:00 p.m.—"How Best Mobilize Our Combined Resources for Chemical Warfare?"

The roles each of us must play in the new MIG program will be outlined by three hard-hitting spokesmen from Military, Industry and Government.

6:00 p.m.—Presidential reception and cocktail party for honored guests

7:00 p.m.—Eighth Annual Banquet, Starlight Roof (Speaker to be announced)

Ladies

Please write Chairman Eugene McCauliff, Glyco Products Co., Inc., 26 Court St., Brooklyn, N.Y., if you are planning to bring your wife, family or other lady guests. It's important in making arrangements for the Breakfast at Altman's, the Greenwich Village tour and the yacht trip around the Island.

Registration

Members are urged to make their hotel reservations promptly because May is always a busy month in New York City. If you run into difficulties, write Chairman McCauliff or Howard T. Von Oehsen, Heyden Chemical Corp., 342 Madison Ave., New York, N.Y.

An over-all registration fee will cover the two cocktail parties, the banquet and the meeting.

NEW YORK *in the Springtime*

This is a famous view of New York's Skyline as seen by visitors arriving from overseas on the luxury liners. You can get the same thrill from the Staten Island Ferry. Fare 5 cents.

O. Henry called it Bagdad-On-the-Subway. It's the city that has everything—for everybody. And all agree that it's at its best in the Springtime. So you'd better make your plans now to attend the next big AFCA meeting at New York's famous Waldorf-Astoria, May 20 and 21.

They tell a story of a little old lady from the hills of Tennessee who never had quite enough of anything, whether it was shoes and stockings or beaten biscuit and corn pone. When she got to see New York all she could say was, "Mister, you sure got something here there's enough of." And that's just what the New York Chapter is promising as an extra dividend to all who attend this important meeting. Besides the fine program (page 3) there will be "enough" of whatever else you're interested in.

If it's history, you're coming at a most significant time. This year the big city is celebrating its 300th birthday. It was on Feb. 2, 1653 that old Peter Stuyvesant signed the first charter for the village then known as Niew Amsterdam. From 800 doughty Dutch burghers, its population has increased to 8,000,000. And there are millions more who visit it each year. To each of them it has its own meaning, its own attractions—just as it has to the members of the Armed Forces Chemical Association.

Have your picture painted by a native artist here in the Bohemian Section of Manhattan. On warm spring days this park at the foot of Fifth Avenue is crowded with people interested in the arts and crafts of Greenwich Village.

New York's newest attraction for visitors is the scene of world history in the making—the United Nations. This great "Parliament for all Mankind" has its permanent headquarters on an 18-acre, 6-block tract extending along the East River from 42nd to 48th Streets. Guided tours through the General Assembly, Secretariat, Conference and Library buildings take place at frequent intervals every weekday.

Tickets can readily be obtained for most of the general meetings. Earphones wired into a telephone dial system at each seat permit you to listen as speeches are simultaneously translated into all the official languages—Chinese, English, French, Spanish and Russian.

If it's art you're interested in, New York has the widest variety—especially in Springtime. In addition to the Metropolitan and other famous museums, there are many less formal exhibits. About mid-May the artists and craftsmen of Greenwich Village hold their famous sidewalk displays and street bazaars. You'll enjoy an evening's walk through Manhattan's Bohemian section, followed by dinner at a popular priced restaurant, or the floor show at one of the Village "hot spots."

If it's sightseeing you want to enjoy without too much exertion, the Committee has a suggestion for you. Why not take

(Continued on page 47)

Greenwich Village has its own "Metropolitan Museum of Art." Its narrow streets are filled with free exhibits of its many artists.

United Nations—New York's newest attraction—see world history in the making at this great "Parliament of Mankind."

Would you like to visit the new U.S.S. United States at its Manhattan pier? That's one of many extra attractions at the New York meeting next month.

"Make Smoke!"

By BROOKS E. KLEBER and PVT. E. LESLIE BYRNES, JR.

Members of the Staff, Historical Office, Office of the Chief Chemical Officer, Department of the Army

Smoke pots at the Sauer River crossing.

"Make smoke" is a popular command in Korea. The Chemical Corps is providing unprecedented amounts of vital smoke screening for the United Nations forces. The value of smoke protection in rear areas and in the combat zone is fully realized. Pusan is a supply port for the United Nations, and it is imperative, particularly with the proximity of a strong enemy air force, that this port receive protection. Throughout this vital area, smoke generator crews are in constant readiness to produce the great man-made clouds that will deny observation to enemy aircraft. In the forward areas infantry, armor, and engineers all gain security and tactical efficiency from similar smoke operations. The origin of this large area screening is not found in recent Korean events, however, but in thirty years of research and practical employment.

The first World War brought to the military a new destructive, long range weapon, aerial bombing. Immediately, the vulnerability of rear area installations was greatly heightened, but anti-aircraft artillery fire and fighter defense were the preferred methods of protection. The tremendous value of smoke was not appreciated since large area screening techniques had not been developed, and only meager progress had been made in developing the necessary agents and equipment.

In 1921, the Chemical Warfare Service began an investigation into the use of smoke, with research centered around the protection of large areas. Fifteen years of sporadic work in the field followed, resulting in a War Department decision that large area screening, though now considered obviously of tremendous potential value, simply was not practicable, at least by existing means. With the eruption of another World War, considerable basic research and development of ideas on large area screening had been accomplished by Great Britain and the United States, but the means of putting these

This screen covered the 30th Division's crossing of the Roer River at Schophoven, Germany.

ideas into practice had not been discovered. The age of smoke had not yet arrived.

Then, in the spring of 1940 Hitler's army swept over the low countries and France, and Luftwaffe airfields were brought perilously close to the United Kingdom. The immediate need for cover for installations increased the tempo of the British screening program. Modified oil burning orchard smudge pots and a mechanical, mobile, oil-burning smoke device known as the Hasler generator were the principal items of smoke equipment employed. Civilians were first pressed into service to maintain the screens, but soon it was necessary to mobilize pioneer troops who worked under civilian direction. By the end of 1940, screening was in full swing and industrial targets were effectively concealed from night enemy bombardment. In the meantime, the Germans were not ignoring this defensive measure. When the British attempted night bombing in September 1940, the vital Dortmund-Ems Canal was effectively concealed, and a similar protective screen was later laid over the great harbor at Brest where the battleships Scharnhorst and Gneisenau were anchored. Throughout the following year smoke, increasingly employed, became indispensable. Large area screening was proving itself.

In spite of improvements in the screening equipment available, operational difficulties arose. The generators used a tremendous amount of oil and all of the oil had to be imported. When smoke pots were used, each had to be started by hand which made the manpower requirements inordinately high. These developments in Europe were not ignored by the CWS in the United States. Our research and development program was pushed forward with emphasis on both the improvement of existing methods and on basic research for new ideas.

In the fall of 1940, as the clouds of war grew darker on the American horizon, a conference at Edgewood Arsenal in Maryland marked the start of the intensive search for new screening principles and agents that was to lead to one of the most significant weapons employed during the war. A statically produced, highly efficient screening agent providing a less objectionable smoke than those available was a basic need. The first requirement in meeting this need was a fundamental investigation of the effect of particle size and composition of both solid and liquid smoke agents. Only then would further development be practical.

From the General Electric plant at Schenectady came the man who was to discover the secret of the smoke screen, Dr. Irving Langmuir. Dr. Langmuir, previously engaged in rain making research at Schenectady, worked persistently on the problem during the following year in collaboration with Dr. Vincent J. Schaeffer. In January 1942, Dr. Langmuir was ready to report that he had determined, both theoretically and by experiment, the exact micron size of the most persistent smoke particle. When oil is heated under pressure the speed of the vapor at the orifice draws in cold air which mixes with the vapor and condenses it into fine particles. The size of the smoke particle is determined by the pressure at the orifice, by the inside diameter of this opening, and by the viscosity of the oil. Three months later an experimental model was tested and as the smoke rolled down the Schoharie Valley near Schenectady the veil was lifted from the basic principle of efficient screening. When the Standard Oil Development

The M1 Generator in Action.

The M2 Mechanical Generator, shown here on the Ninth Army front, was developed in time for the Normandy invasion.

A demonstration smoke screen at Palermo, Sicily.

Company built a field size generator of this type, tests indicated that the "Esso Junior," as the model was dubbed, was about twice as efficient as the best of other models and about ten times more efficient than the British Hasler generator. The principles of science had been applied to the military arts and a major advancement had been made.

There still remained, however, several objections to the "Esso" model to overcome. England's oil supply problem was a matter of grave concern. Supply was further complicated by the requirement of two grades of oil plus gasoline and water. Then, the color of the smoke presented a problem. Because it was so white it did not blend with the surroundings at night and might thus attract the attention of enemy bombardiers. Would not a darker smoke be more satisfactory, even if the machine were less efficient? A new means of screening had been discovered; efforts must now be aimed at perfection.

Before one of these generators would produce oil smoke a warm-up period was required, a period that might see the approach of the enemy. Something had to be done to make smoke immediately. The answer was the HC smoke pot. By attaching an electrical ignition device large numbers of pots could be fused simultaneously, and an almost instant screen could be produced. It was this system that alleviated the shortage of operators. The HC smoke pot was of particular value in filling gaps in a generated screen resulting from changes in wind or from mechanical failure.

With the sudden attack on Pearl Harbor by the Japanese, the United States was swept into full-scale war, and the need for defensive measures became imperative. The dangerous position of the aircraft plants on the West Coast seemed particularly to demand attention. To these screening projects the Chemical Warfare Board gave the highest priority, while the War Department, in the meantime, mobilized smoke troops. The first smoke companies were activated in April 1942 and by the following February there were forty companies. It was while these extensive defensive measures were being organized that it was disclosed that a new, almost revolutionary means of making smoke would soon be available, the Langmuir-Schaeffer mechanical generator. A quick, clean, persistent mist from fewer generators using less oil had been found. Concurrently with these developments smoke installations for Western defense were becoming less urgent as the defeat of the Japanese fleet in the battle of Midway and the rise of American air power lessened dangers to our own shores. But new needs were arising overseas.

Early on the morning of 8 November 1942 the allied forces invaded North Africa. No opposition from the Luftwaffe was encountered during the initial landings so that smoke played little part in the operations, but as the armies rumbled across northern Africa smoke proved its worth. The security of the initial port areas represented the key to allied supply lines, while the drive to the east brought the troops increasingly nearer to German airfields. These conditions made concealment essential.

A total of fourteen major and five minor ports in North Africa and Sicily received smoke protection. The speed and efficiency of the smoke generator units was characterized in providing a screen for Bizerte. Within twelve hours after General Bradley's II Corps captured the city on 7 May 1943 the port was screened, and it was to be one of the most frequently screened ports in North Africa. This principal marshalling port for the invasion of Sicily and Salerno was the scene of some of the heaviest Luftwaffe attacks. So effective was the cover that early in the morning of 6 July, forty-five minutes of almost uninterrupted aerial pounding left untouched a harbor full of ships gathered for the impending invasion.

A light smoke haze limits enemy observation as the 30th Division crosses the Rhine.

A smoke screen conceals infantrymen as they are about to cross the Rhine in motor-powered assault boats.

With African ports secured, the conquest of Palermo and Salerno opened the door to the Italian peninsula, and the allied troops fought their way northward. Naples immediately became the main supply port of the Mediterranean Theater on its capture, 1 October 1943, and it was the scene of the most extensive port screening operation of World War II. Twenty miles of coastline were blanketed during critical periods by one massive smoke cloud blended from separate generating installations. As many as 180 mechanical generators and 500 smoke pots were on stand-by orders throughout the night to produce a screen at a moment's notice. Ten boats were on hand to drop floating pots off-shore when the wind blew from the sea. On a few occasions the screen was "patchy" because of adverse winds or a short warning, but generally the screening was eminently effective in keeping enemy aircraft, especially flare layers, away from the critical area. The land smoke forces from October 1943 to May 1944 consisted of about one thousand officers and men. When intelligence reports indicated that an ancient castle in the harbor served as a guide for the raiders, several additional generators easily blanketed the structure. The continuous glow from another ancient landmark, Mount Vesuvius, was a problem never solved, but the German bombers failed, nevertheless, to locate the ships and installations in the port.

The raids against Naples practically ceased as the Germans retreated northward following the breakthrough in May 1944. The single pot ring which remained around the harbor was manned by Italian personnel. The Americans and British were moving northward or preparing for similar missions in Southern France.

The Italian campaigns were fought in a rugged terrain of hills and narrow passes. Tactically, cover was a necessity as the Germans generally held the high ground commanding fine positions for observation, while the Allies endeavored to push up the valleys in the face of observed artillery and mortar fire. This situation, not previously encountered, called for new tactics. It was impractical to lay and maintain the customary continuous screen over widely scattered German observation posts. Therefore it became necessary to conceal our own combat forces rather than the enemy. The HC smoke pot was still the accepted primary means for statically producing tactical smoke, but experience at the landing at Salerno suggested the value of the mechanical smoke generator for forward area screening. The smoke screen had been considered as essentially rear-area, defensive measure, but Salerno afforded the first significant glimpse of its tactical possibilities. It was the landing of the VI Corps at Anzio on 22 January 1944 that was to prove the use of smoke in combat.

The 24th Chemical Decontamination Company which had screened the beaches at Salerno was included among D-Day troops to guard against expected vigorous opposition from the air. As night fell on D-Day the smoke unit laid a blanket over the beaches which, within the next two days, extended almost two miles, and this was increased still further as beachhead forces were augmented and air defenses strengthened. As the battle moved into February, German bombers were forced to cut the number of raids, for their losses were not commensurate with gains from their ineffective bombing. But this was the elimination of only one danger. For during the daylight hours shipping operations were frequently curtailed because the beachhead was exposed to enemy artillery fire.

Efforts to blanket the surrounding enemy observation posts brought poor results for the mountains looming above the forward area afforded an unrestricted view of the beach installations and the ships in the harbor. The idea of smoking the beach and harbor during the day was received unenthusiastically by naval, artillery, and air defense commanders. They feared that a screen of the density previously employed would hamper their operations. The problem was resolved by the creation of a light haze over the harbor and beachhead which denied enemy observation but did not interfere with the various activities. Thereafter, regardless of the direction of the wind, the unloading of ships and the movement of troops were not visible to German observation points. Yet there was visibility for a safe movement in this artificial fog. The screen was soon tested in other tactical areas and its worth was proved time and again in lives saved. The claim of Colonel Walter A. Guild, the VI Corps chemical officer, that "smoke came of age at Anzio," had much justification.

Forward area screening, first developed in Italy, played an important part in the American drive across France and into Germany. There were twenty-one smoke generator companies in that theater available for port and forward area screening. Most smoke activity was tactical, however, since Allied air superiority largely eliminated the need for screening ports.

Smoke plans for the Normandy invasion beaches were detailed and comprehensive. Moreover, provision was made for cloaking the embarkation ports of southern England with smoke. As it turned out, the Luftwaffe on D Day failed to appear in strength. Consequently, although a smoke screen could have been laid over Omaha Beach that morning, there was no need for it. The smoke units in England, however, did have several occasions in the weeks before 6 June to provide protection against enemy bombing raids.

Of the four United States Armies in the ETO, the Third and the Seventh made the best use of smoke troops. The two most requested missions were those of concealing bridge sites and screening main supply routes.

The first employment of smoke generators in forward posi-

Below: A screen from airplane smoke tanks covers the airborne assault of a New Guinea airstrip.

Bottom: The 388th SG Company in Korea provides cover for an engineer unit as it destroys a bridge.

tions in the ETO took place early in August 1944 at Mayenne, France. During the initial stages of the St. Lo Breakthrough the Germans, in an attempt to delay the American advance, destroyed most of the bridges across the Mayenne River. In order to protect the few remaining structures, General Omar Bradley ordered the area protected by smoke. Two smoke generator companies, hurried from Omaha Beach, successfully screened the bridges from enemy bombings and artillery. From that time on, across France and Germany, smoke units efficiently laid screens to provide cover in attacks against enemy strong points and in assaults across the many rivers that lay between the Allies and victory.

The Moselle, the Saar, the Roer, the Rhine—these were but a few of the rivers infantrymen and the engineers crossed under the welcome protection of smoke. The 30th Infantry Division's crossing of the Roer River affords an opportunity to examine in detail the use of smoke for maximum assault efficiency with minimum loss of life. After rectifying the temporary setback of the German winter offensive the Allies again looked east toward the Rhine. In the ground plan to take Germany's last great natural barrier, the Ninth Army had as its mission crossing the Roer and, after driving northeast, clearing the west bank of the Rhine in collaboration with the First Canadian Army.

The Roer crossing was scheduled for early February 1945. However, the enemy, controlling the dams up the valley, was able to release water to flood the river making an assault crossing unfeasible. Thus, the Ninth Army delayed its attack until 23 February. The Army's front included two Corps, and the 30th Division held down the right flank of the Corps on the right. The two assault regiments of the division were to cross the Roer in the vicinity of Schophoven and Pier and then drive to the Cologne-Julich highway.

In the original smoke plan for the operation both crossing sites were to be screened for the twelve daylight hours of 23 February. The smoke operations were to be controlled by the division commander and supervised by the division chemical officer. At first, only one section (twelve generators and crews) of the 83d SG Company was available for the mission, but men from an infantry regiment and another chemical unit augmented this force. The men of the 83d, during the nights preceding the attack, dug foxholes, prepared generator positions, and set up supply dumps.

Early in the morning of 23 February, under cover of darkness and with the noise of their movement drowned by an extremely heavy artillery preparation, the smoke troops went forward to their positions. The infantry assault progressed successfully. At dawn generated fog replaced the cloak of night. The northern crossing side (at Schophoven) was effectively concealed the entire day as the infantry crossed the footbridge and the engineers worked on a treadway bridge. Enemy artillery, fired at random into this haze, was inaccurate and ineffective. The division commander ordered the screen continued throughout the night and the following day as a protection against the Luftwaffe. Shifting winds caused several moves of generator positions.

The smoke operation at the southern site was not as successful. Erratic winds tore holes in the smoke screen, allowing enemy artillery to range in on the crossing. With the loss of adequate concealment bridge building operations ceased. The screen, however, was effective enough to allow boats and alligators to transport one infantry battalion to the far side of the river. On the following day more trouble in maintaining an adequate screen was encountered but by mid-afternoon the enemy had lost his observation of the area and bridging activities went on unmolested. During the night of 23-24 February the division, in extending the bridgehead, eliminated enemy observation on both the bridge sites.

The Roer River area screens were a positive contribution to the success of the 30th Division's assault. They enabled the engineers to begin construction on the vehicular bridge at the northern site five hours earlier than had been anticipated. Moreover, the engineers, working continuously without suffering a single casualty, completed the vehicular bridge by H+21 hours instead of the estimated H+36 hours. The smoke screens had performed the additional duty of screening the troops as they moved to the river and again after they had crossed, advancing forward in their attack toward the east.

Across the Rhine and deeper into Germany, smoke generator companies continued in the front lines giving their invaluable support.

The similarities in area screening in the two European theaters are obvious. In the Pacific, however, an entirely different situation prevailed; chemical smoke generator units here were not employed in area screening operations. Smoke operations in the two hemispheres differed for many reasons. Allied global strategy assigning first priority to winning the war against Germany was probably the factor of greatest importance although enormous distances and wide dispersion of operations over six theaters undoubtedly prevented rapid development of smoke techniques. As a result of the first factor, smoke generator companies were not available in sufficient numbers to man all points at which smoke might be used.

Distances precluded the use of smoke forces not highly mobile. Only the Navy and the Air Force could move with sufficient rapidity to meet smoke requirements. Difficulties of transporting and equipping CWS smoke units outweighed advantages to be gained from their employment. Wide dispersion of operations made smoke training and supply for non-CWS units virtually impossible except at major bases. Smoke in the Pacific therefore, became the province of the Air Force, whose operations were planned by their own chemical sections, and the Navy, who often called in CWS personnel.

The Air Force made use of aerial smoke tanks, fastened beneath the wings of planes, in their screening operations. One of the outstanding air screening missions took place on New Guinea, in September 1943, when American paratroopers attacked and captured a Japanese airstrip. This particular operation was supervised by air chemical officers of General MacArthur's command. Seven smoke trailing bombers swept low over the field cloaking the wooded area which contained defending Japanese troops. Paratroopers dropped on the airstrip behind this protective wall and there organized a successful attack on the installation.

The Navy, more vulnerable than land forces to Japanese air attacks, used smoke pots and naval smoke generators to conceal their supply and tactical operations. By the time of the Marshall Islands campaign area screening of anchorages had become an accepted practice. At Saipan the smoke screens proved to be "the greatest factor in the . . . defenses of the transport areas against air attack." The advent of the Kamikaze attacks gave impetus to large scale port screenings. A CWS officer at Okinawa, for example, directed smoke activities which resulted in the safety of every ship within the screen while unprotected vessels were seriously damaged.

Although VJ Day took place before the final plans for the invasion of Japan were completed, there would have been, quite probably, an extensive use of smoke generator troops if the landings in Japan had been made. Thus, the last consideration of smoke operations in World War II concerned an area less than 200 miles from Pusan, one of the vital centers of the current use of smoke.

By the summer of 1951 the front lines in Korea became more or less stable and screening was used for relatively small scale, albeit significant, tactical operations. It was rather in the readiness for screening the major supply points, such as the strategic Inchon-Seoul section and the important Pusan

(Continued on page 40)

General Aniline & Film Corporation's high-pressure acetylene products plant at Grasselli, N. J., has been a major reason why the company has maintained its pioneering position in this new field of commercial organic chemistry.

INDUSTRIAL USES OF ACETYLENE

By JESSE WERNER, Ph.D.
Director, Commercial Development Dept.
General Aniline Works Div.
General Aniline & Film Corp.

Pharmaceuticals, such as Polyvinylpyrrolidone (PVP) a blood plasma expander being weighed here, are among the many important high-pressure acetylene products produced by GAF.

A whole new realm of commercial organic chemistry was opened during the late 1930's when the German chemist, J. W. Reppe of I. G. Farben, mastered some of the difficulties of handling acetylene gas under high pressure to synthesize many valuable chemical products. In this country, General Aniline & Film Corporation became the pioneer in the development of high pressure acetylene technology and currently enjoys the position of acknowledged leadership in this new field.

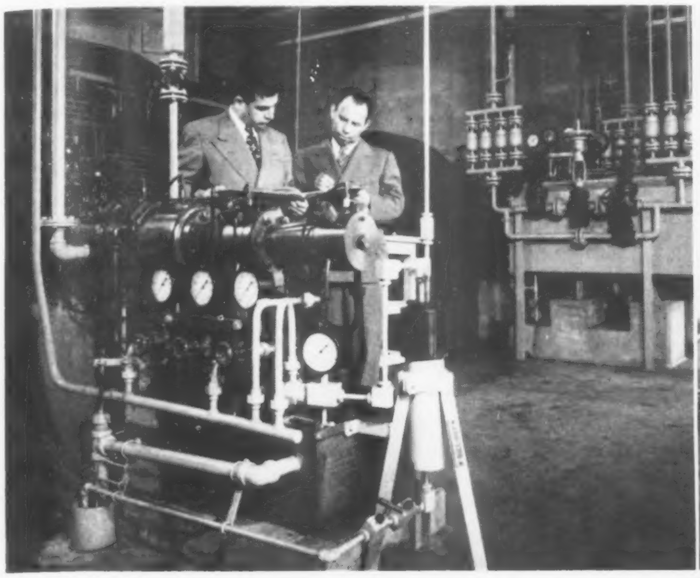
Historical Background

GAF's interest in the subject stemmed directly from the Company's connection with the I. G. Farben organization prior to 1942. After the seizure of GAF by the Federal Government, following America's entry into World War II, the attention of the new American management was drawn to some patents which the Company had purchased from the I. G. two years earlier. Some of these covered a portion of the Reppe work on high pressure syntheses involving acetylene.

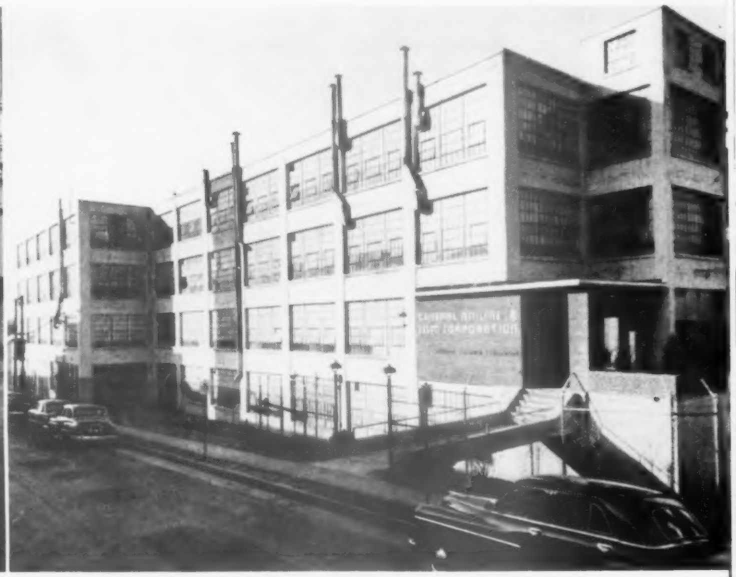
The new American management of GAF quickly realized the import of the Reppe syntheses and almost immediately launched its "New Fields" program to extend its know-how in the manufacture of acetylene chemicals. Within a short space of time the American war effort was supplied with two very vital acetylene compounds, products of this GAF program; Polectron, a dielectric material for use in proximity fuses; and Koresin, a tackifier for synthetic rubber.

The end of the war brought some easing of equipment and material shortages and made it possible for GAF to design and procure those types of highly specialized pressure-proof equipment required to extend further the research and development work on acetylene derivatives. The staff and facilities assigned to the "New Fields" program at the Central

The compressor room at GAF's high-pressure acetylene products plant is its heart. Batteries of multi-stage compressors raise the pressure of acetylene before it is introduced into reactors to make a host of new industrial chemicals.



The Central Research Laboratory of the General Aniline & Film Corp. at Easton, Pa. figured importantly in the pioneering work of the company on High-Pressure Acetylene derivatives.



HIGH PRESSURE ACETYLENE DERIVATIVES

Research Laboratory of the Company at Easton, Pennsylvania, was greatly augmented and by 1946, the progress of the entire program had reached a point sufficiently advanced to justify the erection of a pilot plant using commercial-sized production equipment. An area adjoining GAF's huge dyestuffs and chemicals plant at Grasselli, N. J. was chosen as the site and the pilot plant was formally opened in the spring of 1948.

Coincident with this, it was decided to again increase the size of the high-pressure research facilities of the company's laboratory at Easton and move the acetylene work to a separate building. This step was taken in anticipation of the increased amount of process information that would have to be developed for the pilot plant.

Actually, the Grasselli installation is much more than a "pilot plant" in the usual sense of the term. It is capable of processing tonnage quantities of materials on a scale considerably greater than many full scale plants in other segments of the chemical industry. Its equipment, though for the most part specially designed, is of a size and capacity employed in the construction of heavy production-rated chemical units. And it requires a staff of over fifty for maximum operation, a sizable complement for a thoroughly-instrumented chemical plant.

Although GAF's "New Fields" program only achieved its full stride in the postwar years, the accomplishments to date have amply justified the management's faith in the future of high-pressure acetylene derivatives. Almost 400 patents on acetylene work have been issued to GAF. And currently the Company is engaged in many cooperative research and development ventures with other industrial firms and various government agencies to explore and extend the application of the new acetylene-derived compounds in many fields. The status of some of these studies will be reviewed later in this article.

But it is most significant that this entire multi-million dollar program was initiated and maintained by a Company with no opportunity to raise venture capital, since GAF, as a ward of the Federal Government, has no normal access to the equity market. The Company is justifiably proud of the progress that has been made in spite of this handicap in opening up this promising new type of chemical enterprise.

Acetylene — A Versatile Material

Acetylene has long been recognized as an extremely versatile chemical compound, perhaps the most facile building block available to the synthetic organic chemist. The triple bond between its two carbon atoms, the heart of the molecule, is the reason for its extreme reactivity. But this same reactivity makes it imperative that acetylene be handled most cautiously, particularly when it is being used under elevated pressures where it is liable to explode.

The dangers and difficulties of handling the gas generally discouraged the development of high pressure acetylene processes in this country. In addition, there was not the need as there was in Germany to base so much of the nation's chemical economy on the use of coal and coke-derived raw materials such as acetylene.

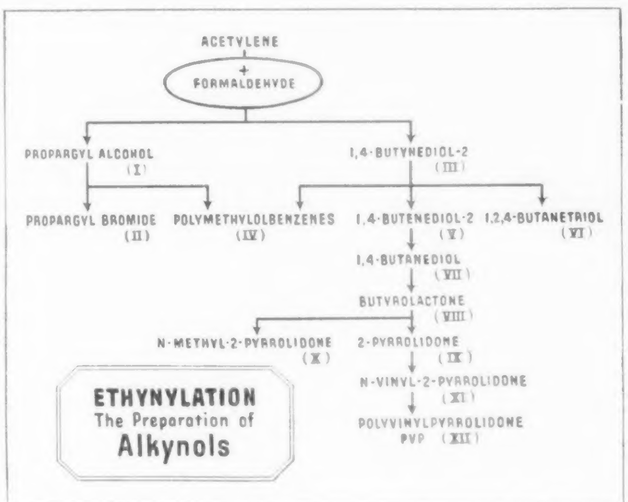


Fig. 1

Several chemical enterprises were built, however, during the past forty years based upon the reactions of acetylene at low pressures and moderate temperatures. These included the production of chlorinated solvents, acetaldehyde, vinyl acetate, chloroprene and vinyl chloride. But the fact remained that low pressure syntheses were limited in the extent to which they could take advantage of the extreme versatility of the acetylene molecule.

The technique developed in Germany and improved and extended by GAF permits the safe use of acetylene at elevated pressures and temperatures and makes possible a much greater variety of acetylene derivatives. This technique consists of two basic methods which involve (1) diluting the acetylene with an inert gas, or (2) using acetylene in equipment so designed that no free empty spaces of cross-sectional area greater than 0.25 square inches are permitted.

The planning and construction of the pilot plant and the design of its specialized equipment, safety devices and the extensive instrumentation it employs constituted a major engineering job. Reaction equipment, for instance, had to be designed to withstand tremendous overloads of pressure. And entire production units had to be located behind steel reinforced concrete walls and heavy steel plate.

The two principal processes being run in the GAF plant are ethynylation, to prepare alkynol compounds, and vinylation, to prepare vinyl ethers and esters. The mechanisms of these processes and their products are considered separately in the following sections:

Ethynylation

Ethynylation refers to a reaction whereby acetylene is condensed with a reagent such as an aldehyde so that the triple bond of acetylene is preserved. The German work revealed that by using acetylene under pressure at elevated temperatures, it would react with either one equivalent of formaldehyde to form propargyl alcohol, or with two equivalents to form butynediol. In both cases copper acetylide is employed as the catalyst.

The process begins by mixing dilute aqueous formaldehyde with undiluted acetylene under 90 lb. per square inch of pressure. The mixture is passed at about 100 deg. C over the copper acetylide catalyst (containing bismuth to prevent cuprene formation). The products are then degassed, any unchanged formaldehyde and propargyl alcohol being removed by distillation. The main product, butynediol, is obtained as a concentrated water solution from which it can be isolated as a colorless crystalline solid. The two step chemical reaction is written as follows:

$$H{-}C{\equiv}C{-}H + CH_2O \rightarrow H{-}C{\equiv}CCH_2OH$$
propgargyl alcohol

$$H{-}C{\equiv}CCH_2OH + CH_2O \rightarrow HOCH_2C{\equiv}CCH_2OH$$
1, 4-butynediol-2

Alkynols and Derivatives

All of the compounds shown on the Ethynylation Flow Sheet (Fig. 1) are in various stages of commercial development by GAF, many by means of cooperative programs between GAF and other companies. Final field tests are currently being run on several of these materials. The following is a brief account of the present status of the alkynols and their derivatives:

(I) Propargyl Alcohol
Presently under test for use as a rocket fuel, and as an intermediate for essential oils, resins, etc.

(II) Propargyl Bromide
Currently being used in the synthesis of an important pharmaceutical. Also being investigated for use in additional pharmaceutical syntheses.

(III) 1,4-Butynediol-2
Now under study for use as an intermediate for rocket fuels such as diacetylene and for plasticizers, solvents, etc.

(IV) Polymethylolbenzenes
Being studied for use in alkyd resins, where harder, more lasting film resins are desired.

(V) 1,4-Butenediol-2
Under study for use as intermediate in epoxy type plasticizers and other products.

(VI) 1,2,4-Butanetriol
Butanetrioltrinitrate appears superior to glycerol trinitrate with respect to plasticity, stability and toxicity.

(VII) 1.4-Butanediol
A polymeric plasticizer made from butanediol is now under extensive consumer tests. It shows excellent low-temperature characteristics, non-extractibility, lack of migration and ease of incorporation. This material is now being produced in Germany also by two companies who began manufacturing it after they learned of GAF's success with the product. It may be of considerable interest for low temperature military use. Several interesting new fibers have also been made from the material. New lubricants using it as a base are also under study.

(VIII) Butyrolactone (see below)

(IX) 2-Pyrrolidone

(X) N-Methyl-2-pyrrolidone
These three materials are now under study for (1) the spinning of polyacrylonitrile fibers and (2)

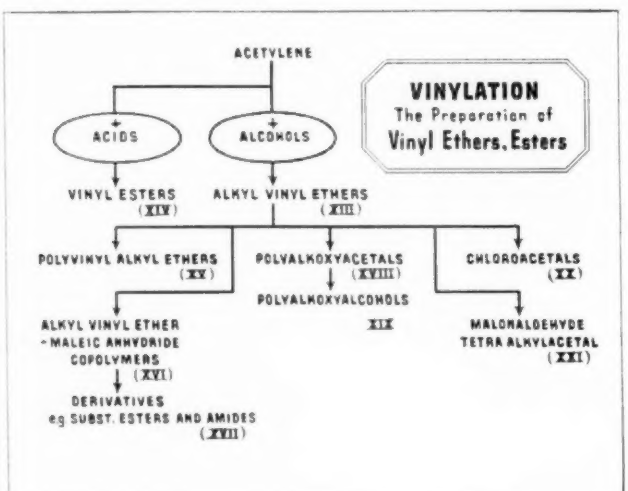


Fig. 2

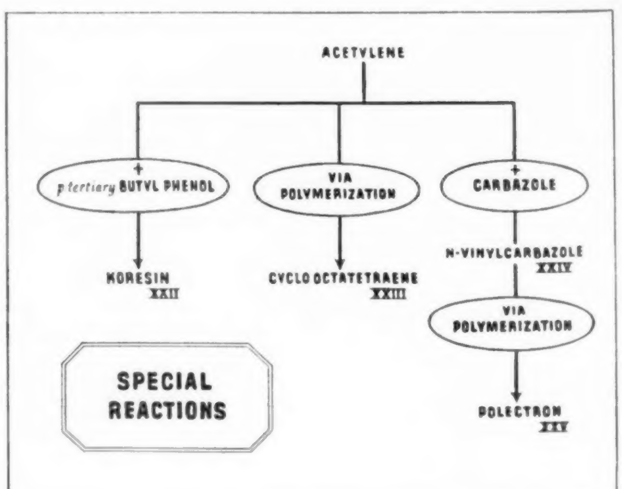


Fig. 3

the purification of acetylene and other gases by selective absorption.

(VIII) Butyrolactone

This compound is also interesting as an intermediate for the preparation of thiodibutyric acid, a dibasic acid which shows promise in the production of new plasticizers.

(XI) N-Vinyl-2-pyrrolidone

This compound is currently under study as a monomer for incorporation in new fibers to improve color, hand, dyeability, physical properties, etc.

(XII) Polyvinylpyrrolidone (PVP)

One of the most versatile of the high pressure acetylene derivatives, PVP has many proven applications, most of which lie in the pharmaceutical and cosmetic fields:

(1) Blood Plasma Expander—The U.S. Armed Forces are now procuring 500,000 units of GAF's PVP in physiological saline solution for stockpiling. The Federal Civil Defense Agency has already procured 1,200,000 units for stockpiling. Currently being used extensively in several hospitals in this country including Philadelphia General Hospital. Similar situation prevails in France and Germany, where PVP is widely used as a plasma expander.

(2) Drug vehicle and repository—currently being used with penicillin and various other drugs.

Reinforced concrete and steel barriers protect workers from an accidental explosion of acetylene at General Aniline & Film Corporation's high-pressure acetylene products plant at Grasselli, N. J. The plant is the only one of its kind in the Western Hemisphere.

(3) Suspending agent for various drug dispersions and emulsions.

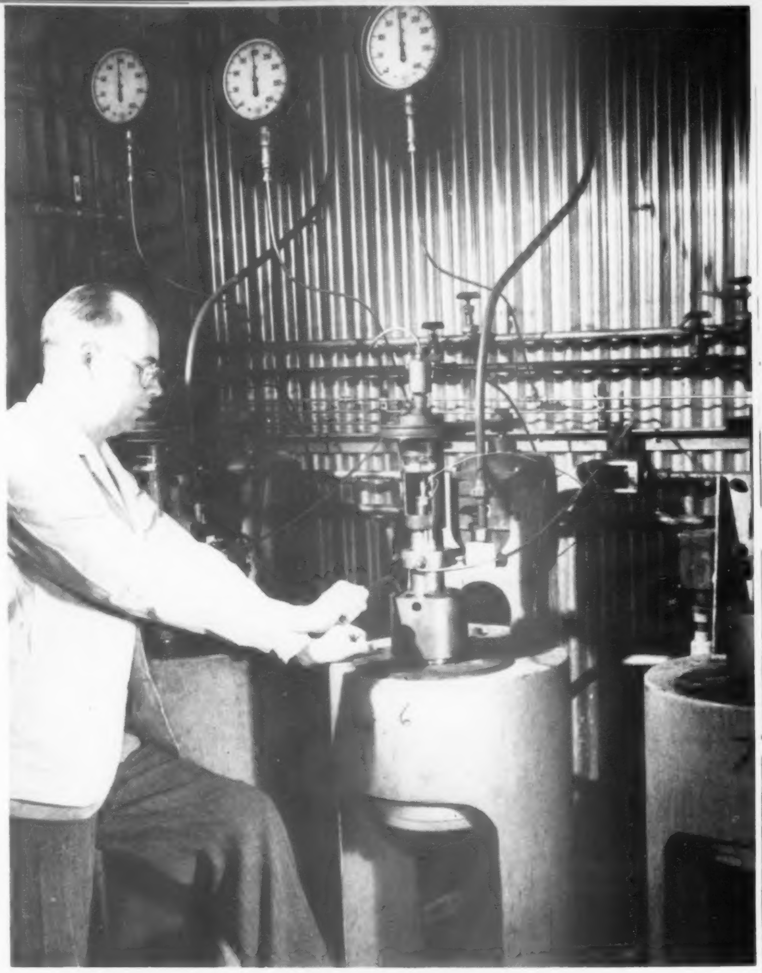
(4) Tablet binder—presently being used for a variety of tabletting operations.

(5) Used for the production of PVP-Iodine, a soluble, detoxified, non-irritating, non-staining form of iodine which retains all of its germicidal properties.

(6) Detoxifier for a variety of poisons and toxins.

(7) Presently used in the cosmetic field as a film-former and solubilizer. Very compatible physiologically with skin and hair.

(8) Stripping of various classes of dyes from dyed fabrics.



Preliminary test runs of new processes using acetylene under pressure are carried out in special reactors at GAF's Central Research Laboratory at Easton, Pa. After the "bugs" are eliminated the processes are then employed in the multi-million dollar high-pressure acetylene plant of the company at Grasselli, N. J.

Vinylation

Theoretically, the term vinylation includes any process whereby a vinyl group ($CH_2{=}CH{-}$) is introduced into a molecule. In today's general usage, however, it is understood to mean the introduction of a vinyl group by reaction with acetylene. Acetylene, as previously indicated, is extremely active and adds to its triple bond many reagents such as acids, alcohols and the like at moderate temperatures and at practically atmospheric pressure. If the addition stop at that of one molecule of reagent a vinyl compound results. However, in the past the addition of alcohols to acetylene could not be stopped at this first stage because the initial products, vinyl ethers, were too reactive to be isolated in the presence of the acid catalysts used.

The work by Reppe showed that the addition of alcohols could be limited to one equivalent, if instead of an acid catalyst, an alkaline one were used at elevated temperatures. Naturally, to carry out such a reaction with low boiling alcohols it is necessary to use pressure equipment. This in turn means the use of acetylene under pressure at elevated temperatures. Under these conditions the practice of diluting acetylene with an inert gas makes possible the safe conduct of the reaction. The process is described as follows:

$$H{-}C{\equiv}C{-}H + ROH \rightarrow CH_2{=}CH{-}OR$$

(alkyl vinyl ether)

Vinyl Ethers, Esters and Derivatives

Like the alkynols and their derivatives, the vinyl ethers, esters and the compounds derived from them are also under-

(Continued on page 56)

SOLDIERS AND SCIENTISTS

PARTNERS IN DEFENSE

By GEN. J. LAWTON COLLINS

IN TODAY'S ARMY it is absolutely impossible for military science to exist separately from the broader fields of science —and this includes not only the research and development of weapons and material but of ideas and techniques as well. Strategy and tactics define our needs and thus influence the direction of our military research and development efforts; but conversely, pure research and development are producing results which will inevitably influence future strategy and tactics.

The basic principles of war, however, remain immutable. For example, the Principle of Surprise remains as valid as ever. The Principle of Economy of Force is just as good today as it was in Napoleon's time. And the Principle of Mass—the concentration of superior force at the decisive place and time —is still as sound as always.

This does not mean that we are backing into the future. For we are applying strategic and tactical concepts to the solution not only of today's problems but of tomorrow's problems as well. Intelligent military planning must therefore be paralleled by a projection of scientific research and development into the future. Today the art of warfare and scientific progress are so interwoven, so interdependent, that it is growing increasingly difficult to draw any theoretical line between them and say that on this side of the line lies military science and on the other side lies non-military science. This is particularly true of war on land.

For this reason the Army in recent months has increased the responsibilties of the Deputy Chief of Staff for Plans by giving him the responsibility of insuring that our strategic planning and our Research and Development Program are in close step and under constant surveillance at the highest level. His main assistant is the Chief of Research and Development.

The working nucleus of our Army-Science team is the Army's Operations Research Office, headed by Dr. Ellis A. Johnson, and operated under contract with Johns Hopkins University. The staff in Washington, now numbering more than one hundred and twenty research personnel, integrates the resources of many of the universities and industrial research organizations of the United States for direct work on new weapons and for the analysis of problems of the training ground and the battlefield. Our research is not limited to the physical sciences. We also make use of advances in the social sciences because we fully realize the importance of the human element in combat.

The Operations Research Office and its many collaborating universities participate directly with the officers of our General Staff in the most critical analysis of the Army's operations. This honest soul-searching is designed to bring about the utmost efficiency as well as economy in the management of the Army and without regard to military or civilian viewpoints. The truth is our only aim. We seek thereby to choose the most modern and effective weapons for the battlefield, which at the same time can be produced at the minimum cost and with the least impact on our national economy. We seek also to insure that our Army personnel are trained by the most modern methods developed in educational research, and that their morale and psychological well-being—as well as physical well-being—are protected and preserved throughout their service in the Army. Above all, we seek to guarantee that the combination of men and machines for combat makes full use of modern scientific knowledge so as to insure victory with the *least* cost in American lives.

For illustrative purposes, consider how we have approached the problem of defeating Communist armor, in case war should be thrust upon us. We believe that the Communists have more than forty thousand tanks. The free world has many less. An obvious solution would have been to attempt to match their armor—tank for tank—since the tank is itself a splendid antitank weapon. But it is not the *only* antitank weapon. The facts are that we will not need forty thousand of our tanks to defeat a like number of enemy tanks if a showdown ever comes; moreover, tanks are terribly costly vehicles which take a long time to develop and produce. Therefore we have no intention of trying to match them tank for tank.

For these reasons we have laid great stress on the development of a family of antitank weapons. For defense at short ranges, we have our rifle grenades which are effective against

From an address before the Carnegie Institute Society, Pittsburgh, Pennsylvania. Reprinted by permission from the Army Information Digest, February, 1953.

practically any tank. Our 2.36-inch and 3.5-inch bazookas will knock out enemy armor at slightly greater distances.

Next in the family are the recoilless rifle—the 57's and the 75's and the new 105's. They fire the same type of shaped charge amunition that the bazooka fires, but to greater ranges. And to reach out still further, we have developed another type of ammunition for use with our standard artillery guns, and this ammunition will also knock out any known tank.

At the same time, we do not neglect our own tank development. Its offensive capabilities remain as important as ever. Consequently we have increased the proportion of tanks in our Army. In our standard infantry division today a tank company is an integral part of each infantry regiment in addition to the tank battalion in each infantry division. In other words, we have the equivalent of two tank battalions in each infantry division, whereas during World War II no tanks were regularly assigned in standard infantry divisions.

We had been working on the development of a family of tanks—light, medium and heavy-gun types since the end of World War II. The superiority of our Sherman, Pershing, and Patton tanks over Soviet T-34 tanks in Korea has been clearly established, vindicating the quality of our armor. In fire power, mobility and ruggedness, our tanks are capable of outmaneuvering and outslugging, if need be, any other tanks in the world.

Our approach to the threat of Communist air attack parallels our solution to the menace of Communist armor. Faced with the possibility of air attacks on our cities, the Army, intensely aware of its important role, is rapidly developing a family of fine antiaircraft weapons.

Our new antiaircraft guns and guided missiles will make our antiaircraft defenses tremendously more effective. For example, we will soon have in the hands of troops a new Skysweeper antiaircraft gun for use against planes flying at low and medium altitudes. It is without question the finest gun of its type in the world. It is radar controlled and can fire at an unbelievable rate against high speed targets under any conditions of weather or darkness. The Skysweeper fires shells with proximity fuses, which burst and cause great damage if they pass close to a target.

This does not mean we are going to shoot down every aircraft which may come over our soil. But it is our belief that such weapons, supplemented by our other new developments in antiaircraft artillery, missiles, rockets and ammunition, and coupled with appropriate radar nets and interceptor aircraft, will aid materially in meeting an air attack.

To guard our homes from enemy attack, we have more than doubled the number of antiaircraft battalions. I emphasize this because I feel many Americans do not realize the effectiveness of ground fire against aircraft. During World War II, we lost many more planes to enemy antiaircraft fire than to enemy planes. And in Korea, 87 per cent of the United Nation's planes lost in combat have been brought down by enemy ground fire.

We also have made genuine progress in our development of guided missiles for the air defense of the United States. I recently visited White Sands and saw some of the firing of our NIKE missiles against aircraft, at ranges and altitudes which have never before been attempted and against targets which were trying to evade the missiles. They are living up to our most optimistic expectations. When they are in the hands of our units, our antiaircraft defense will be many times tighter.

But no war was ever won by remaining on the defensive and so we have emphasized the Army's need to move swiftly and devastatingly against an enemy. In any future war, air mobility will play a major role. Because of advances in air movement we have the potential of moving faster and farther and can hit an enemy with greater suprise than ever before. This increased mobility is multiplying our potential effectiveness both in airborne assault operations and in the strategic movement of troops over great distances.

We are making our standard infantry division air transportable, insofar as it is practicable. Within recent months we have flown our new light-gun tank, the T-41 Walker Bulldog, combat loaded with gasoline, crew and ammunition. This gives us the potential, in the early phases of an airborne operation, to supply our paratroopers with the armor punch they need.

In Korea, we have seen time and again the inestimable value of resupply by air in fast-moving tactical situations. The rugged terrain and inadequate roads and railroads have necessitated supply by air and, in many instances, it has proved to be the best means of supporting our troops.

Army helicopters as well as other light aircraft have been used to transport outpost and observation groups, to string wire communications, and to provide a rapid means of aerial reconnaissance and observation in forward areas. They have been used to evacuate wounded from front-line positions under fire, for the delivery of tank recovery crews, for on-the-spot repair of damaged equipment, for the rapid movement of commanders and their staffs, and—important to soldiers in the line—for flying hot food to men in advanced outposts. New uses for these aircraft are continually being developed, resulting in considerable savings of personnel and equipment. The comander of a regiment in Korea recently referred to his regimental pilot as his "eyes" and stated that he was worth six observers on the ground. A signal battalion commander in Korea reported that one airplane was doing communications work that had formerly been done by twenty jeeps and was doing it better and faster.

But by far the most dramatic progress in the Army's use of new weapons and scientific developments lies in our efforts to exploit the use of atomic weapons on the battlefield, and to prepare to defend against them.

The Army today is engaged in an extensive program to adapt itself to atomic warfare and to prepare both offensively and defensively for the impact of atomic weapons. We are providing field commanders with technical information; our troops are being trained to protect themselves against atomic blasts; and our service schools now give courses in atomic warfare.

We have concentrated on the speedy development of an atomic artillery piece, because our problem lies in being able to place fissionable materials relatively close to our own front-line troops under all conditions of weather and visibility and sometimes on fleeting targets of opportunity. It is a means of delivery which has been completely proven over many years and it is the first means of battlefield delivery under all weather conditions which we can get in the hands of troops. This 280-mm. gun can fire with accuracy comparable to conventional artillery at the relatively short ranges. It is four times more accurate at the longer ranges. It is a weapon that gives us the accuracy and dependability we must have.

This artillery piece, which can fire both conventional and atomic shells, is not much larger than some of our World War II guns and is even more mobile. It can cross bridges capable of carrying any standard piece of equipment in an ordinary Army division. Moreover, it can travel at a rate of thirty-five miles per hour, has excellent cross-country mobility, and can debark over unprepared beaches from a Navy landing utility ship. Once it reaches a designated firing location, it can be emplaced and put into action with greater speed than any other heavy field artillery piece now in use. The gun is so well balanced than one man can easily elevate or depress it by hand if the power unit fails.

Ultimately, as guided missiles are perfected, they will also aid in delivering fissionable materials by the Army in close

(Continued on page 45)

The correct technique of handling a portable flame thrower is demonstrated by Simpson. The student is Pvt. Kenneth E. Magorsen, Detroit, Mich.

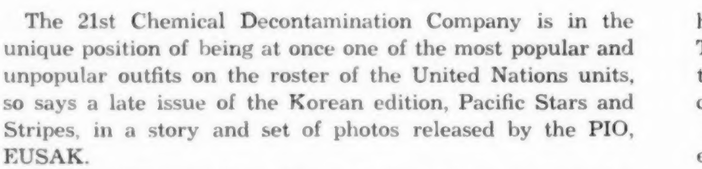
Specialists in "Hotfoots" or

The 21st Chemical Decontamination Company is in the unique position of being at once one of the most popular and unpopular outfits on the roster of the United Nations units, so says a late issue of the Korean edition, Pacific Stars and Stripes, in a story and set of photos released by the PIO, EUSAK.

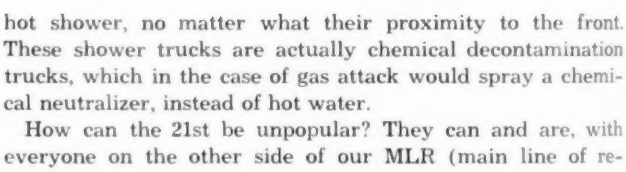
The 21st "Deacons," as they call themselves, are popular all along the winding front largely because of the services performed by their shower teams. Their trucks, carrying large water tanks and hose, offer soldiers the luxury of a hot shower, no matter what their proximity to the front. These shower trucks are actually chemical decontamination trucks, which in the case of gas attack would spray a chemical neutralizer, instead of hot water.

How can the 21st be unpopular? They can and are, with everyone on the other side of our MLR (main line of resistance), because other trucks and teams from the 21st are mixing the napalm used by all the Eighth Army ground forces.

Pfc. Herbert R. Simpson, Falen, Va., is a member of one



Simpson and two members of the 21st's "flame team" with the 25th Division, set up a napalm mine. Left to right: Simpson, Pvt. Levi Peterson, and Pvt. James E. Pringle. (U. S. Army Photos by PFC Joe Mitchell.)



A napalm specialist, Simpson detonates a napalm mine to show students what the flame can do to infiltrators.

Hot Showers

of these "flame teams." He and several other "Deacons" are under the operational control of the 25th Division chemical section, headed by Lt. Col. Joseph Fishback. Working with the division's assistant chemical officer, Capt. Charles C. Follman, they mix the napalm used by that division in its flamethrowers, flares, mines, satchel charges, and bunker bombs.

Simpson, a chemical laboratory technician, is an extremely representative member of the Chemical Corps in Korea. Prior to entering the service, he worked for du Pont chemical corporation in the control lab of their big Waynesboro, Va., acetate plant. After his infantry basic training he went back to the lab—at a Chemical Corps proving ground.

Arriving in Korea in January, 1952, Simpson was assigned to one of the 21st "flame teams" as a "napalm mixmaster."

On a typical day with the 25th Division, Simpson and the other "Deacons" spend most of their time mixing batches of the highly inflammable jell at various consistencies, as required by the weapons. They are responsible for seeing that infantrymen have all this deadly jell they need.

The actual mixing is done in a huge hopper on the mixer-truck. Napalm mix is added to gasoline to produce the required jell.

Throughout the day, Infantry service companies come in to get refills for their portable flamethrowers, or to pick up five or 55-gallon mines or flares.

The 25th Chemical Section is continually training infantrymen in the uses of the "liquid death," and the "Deacons" assist Capt. Follman in schooling more than 300 men a month in correct mine, flare, smoke, and flamethrower tech-

(Continued on page 45)

Right, Top: 25th Division tankmen watch as the "deacons" fill the tank's flame thrower. Simpson adjusts the hose as SFC James E. Boakkeen and Pvt. Levi A. Peterson assist.

Center: Into the hopper PFC Herbert G. Simpson pours the mixture which when added to gasoline will produce the deadly jell.

Bottom: Portable flame throwers are filled with fresh napalm. Here Simpson prepares to fill a container, while CPL Edwin L. Muck watches.

Close up view of glassblowing artisan as he works to devise a new piece of chemical testing apparatus.

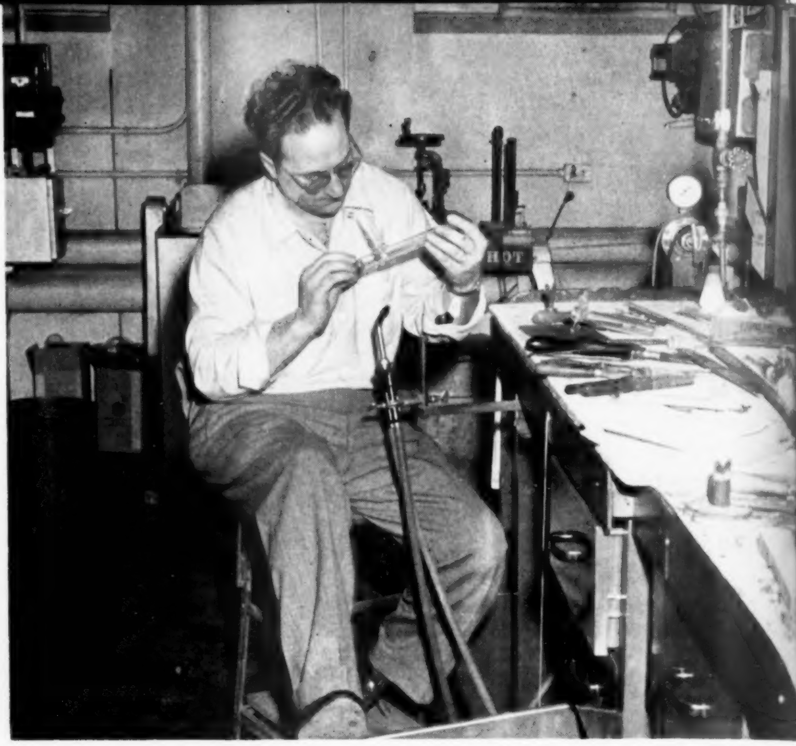


Photo of worker examining glass tubing he has removed from flame.

GLASS BLOWERS RENDER IM

By ZACHARY JAQUETT

ARMY CHEMICAL CENTER, MD.:—If one had not been acutely aware that this was 1953, he could have thought himself in an alchemist's shop of old. Angular pieces of glass stabbing awkwardly into the air or lying helter-skelter upon rough hewn tables enhanced this first impression.

The hot bright light of gas flames was reflected in the intent faces of the artisans employed here as they bent over their work. Every now and then one of the men would hold up a redhot piece of glass to cool. The whir of the carborundum wheel echoed through the room. The attention brought by this sound to modern machinery gave the lie to the alchemist idea. This was the Glass Blowing Shop of the Chemical and Radiological Laboratories at the Army Chemical Center.

Testing and experimentation are bywords for the Chemical Corps. Its missions are in the laboratory where all sorts of defensive and offensive materiel is being constantly developed for utilization by the three major military services. To carry out this extensive research and development program the laboratories need a large amount of testing equipment. Many times individual operations require particular machinery which would not be of use anywhere else. This plus the usual hazards of breakage and an ever expanding experimental program places great emphasis upon an ever ready supply of the proper laboratory equipment. It is the task of the glass blowing shop to answer these needs.

Here briefly is how these demands are implemented by the shop. The agency requiring the equipment issues a work order containing dimensions of the necessary article and a rough sketch of it. When the shop receives the order it goes to work to fashion the glassware. Mr. William Still, chief of the shop, revealed that in some instances they have only a vague idea as to what the piece of equipment is supposed to look like; consequently, they get busy and conjure up their own design and follow it. This is particularly true of an experiment so highly individual that the testing apparatus could not be used for any other.

After watching the glass blowing artisans at work, the conclusion is readily reached that this is intricate and patient work. Timing ranks as equally important to the fashioning of equipment as does breath control. An acute sense of knowing just when to turn the glass upon the flame, when to remove it for cooling, and how mallable it should be for working is a definite part of being a successful glass blower. Mr. Still said that as far as he was concerned this was a quality born in a person. In his thirty years of experience with this sort of thing he has found that people who like to take up glass blowing either have this sense of doing the right thing at the right time or they don't. Glassblowers are born not made.

To see one of these technicians in action let's turn our verbal camera upon him for a close up. He is seated on a high stool, a piece of glass tubing held lightly but firmly in both hands. He is turning it rapidly with an even flow of movement through a bluish-yellow flame. The observer finds it hard to see what changes are taking place in the pyrex tubing as his vision is obscured by the flame. But the workman, equipped with lavender tinted especially ground glasses which filter the sodium content of the flame, knows exactly what he is doing. If he is working over a white hot flame he may wear black goggles.

The flame is fed by a combination of oxygen and gas. It may be adjusted to the degree of heat which the artisan requires. His attention is riveted upon his work for he must remove the tubing from the fire at precisely the right moment or the molten glass will run like water. Suddenly he removes the red-hot tubing which now has the consistency

Photo of glassblowing artisans at work in their shop.

Photo of cabinet with fancy glassblown objects made by workmen of this shop in their spare time.

IMPORTANT SERVICE TO CORPS

of molasses from the fire and slowly pulls the center into a long thin tube. (This is still a cylinder. Even when glass is no wider than a thread it is tubular. By putting it into water and blowing through it this can easily be proven.) Once he has attained the correct length back into the flame the elongated tube goes. Once more it is heated and then removed to be attached to a previously prepared joint. In this way a complicated piece of chemical testing apparatus is begun.

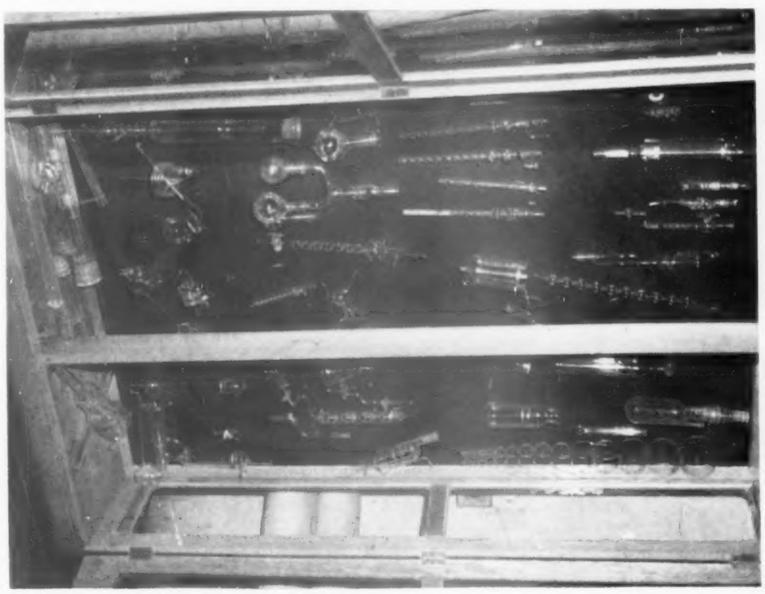
The only thing that the glass blowing shop procures from outside firms are joints and stopcocks and, of course, the tubing with which to work. This glass ware comes in four foot lengths ranging from 3 mm to 100 mm in diameter. The shop is littered with remnants of this tubing and the work man have fashioned it into many different shapes.

An important adjunct to the functions of the shop is Mr. Still's class held for those persons who wish to learn glass-blowing. Through the facilities of the University of Maryland's Graduate Training Program here on the post, college men may elect the course and receive credit for taking it. Last semester 14 men both military and civilian were in the class. They learned the basic techniques of the trade and progressed to the extent they were able to make some simple pieces of apparatus. Mr. Still, who knows just about all there is to know on this subject, was pleased with the strides his pupils have made and is looking forward to the continuation of their work the coming semester.

The telling of the glassblowing shop activities unearths another striking example of how the Army may save money. By making all equipment used in the laboratories the shop saves time. And today time is money. The fact that glass objects may be used more than once to fashion new designs is also pertinent. By devising just exactly what is needed no piece of equipment is wasted because it isn't suitable. These are three examples of how the shop makes a definite contribution to the Army's Cost Consciousness program.

As for the artisans themselves, Mr. Still spoke for them all. They never get tired of their job. There is always something new and different to do. They are in a sense creative artists. Although their creations are utilitarian in purpose, their knack for functional design is an integral part of the Chemical Corps' mission.

Photo of industrial testing equipment made by the glassblowing shop.



By COLONEL GEORGE W. DORN
Commanding Officer
San Francisco Chemical Procurement District

THE STORY OF THE M25A1 "BASEBALL" GRENADE —ITS PRO

The San Francisco Chemical Procurement District, a Class II Installation, is charged with the responsibility of the procurement of current and anticipated requirements of certain Chemical Warfare Materiel for the Armed Forces and the Procurement Planning for them under the Industrial Mobilization Program. The main office is located at Fifteenth and Clay Streets in downtown Oakland.

The San Francisco Chemical Procurement District is one of six similar establishments located geographically throughout the United States. The area which comprises this District is as follows: The western states of Washington, Oregon, California, Idaho, Montana, Wyoming, Utah, Nevada, Arizona, the territories of Alaska and Hawaii, as well as some of the insular possessions. In this area, the District does all of the Procurement Planning, inspects all materiel being procured, and makes the plant surveys required for production and security purposes.

Now let us examine the differences between Procurement and Procurement Planning. Procurement is the actual procuring or purchasing and inspection of material needed to supply the current or anticipated requirements of the armed forces. This may mean the procuring of materiel to be shipped to depots and stored for future use or shipped to arsenals to be used in the manufacture of various Chemical Corps items. It may mean the procuring of spare parts for end items now in use, specific component parts to be used in the assembly of an end item (complete unit) at an arsenal or other assembly plant, or the procuring of the entire end item itself. Procurement Planning is the voluntary cooperation between the manufacturer or facility and one or more of the various agencies of the Department of Defense, whereby the manufacturer having the desire, ability and facilities, expresses a willingness to convert to war production in the event of total mobilization. After the governmental agency has determined that the manufacturer or facility has the ability to produce the required number of items of acceptable quality in the required time, the manufacturer simply confirms this ability and agrees to supply them in the quantities needed in the event of an emergency. No compensation is paid by the Government to these possible suppliers during this planning period.

The program is called the Industrial Mobilization Planning Program. It is coordinated by the Munitions Board and the Department of Defense. The plan is designed to effect nationally an orderly distribution of the initial wartime manufacturing load among existing industrial facilities.

Because the M25A1 Grenade involved both Procurement and Procurement Planning, as well as coordination with other Chemical Procurement Districts, it is being used as the example for this article.

Cemented Body Assemblies on Conveyor Entering Infra-Red Oven Grenade Hand, Riot, CN, M25A1.
Fig. 1

Fig. 2
Donald Gardner, Resident Inspector, SFCPD, Testing the M25A1 Grenade Body Assemblies for Leaks, CN Filling Plant at the Eldon Manufacturing

PROCUREMENT PLANNING AND PROCUREMENT

The Grenade is designed primarily for use in the control of riots, mobs and other civilian disturbances, and may be used in controlling disorders arising in prisoner-of-war camps. The Grenade is filled with CN (Chloracetophenone), more popularly known as "tear gas." The CN is solid, but is micropulverised for the filling. The Grenade is approximately the weight, size and shape of a baseball; and anyone who has at one time played baseball will find he can throw it with ease and accuracy.

Effective use of the Grenade is not dependent on the wind for distribution. For best effect, it should be thrown to explode a few feet over the target. There is no visible cloud of CN produced, and there is no fire hazard involved. Because of its plastic body, there is little danger of causing physical injuries upon explosion. The delay time of the fuse is approximately two seconds after leaving the hand of the thrower, which makes it practically impossible to pick up and throw back before exploding.

The Grenade is molded of phenolic resin plastic in two halves which are later cemented together. Inside sleeves, integral with the two halves, telescope and form a cavity through the center of the grenade, which becomes the casing for the firing components. The firing components consist of a safety pin, safety-balls, arming sleeve, arming spring, firing spring, slider, detonator assembly and a firing pin. A duplicate of the firing pin serves as a closure plug for the cavity, which contains the tear gas mixture.

In the fall of 1947 the Chemical Corps Procurement Agency, Army Chemical Center, Maryland, contacted the San Francisco Chemical Procurement District and requested a list of bidders for the M25A1 Grenade. The grenade had been standardized shortly before as the M25, and it was now proposed to negotiate a contract for a sizeable quantity of plastic and metal components and ship these to Edgewood Arsenal for assembly and filling.

At this time the District office was located at Fort Mason in San Francisco, and was engaged in limited inspection and Procurement Planning activities. A list of qualified bidders for the production of plastic and metal components was furnished the Chemical Corps Procurement Agency; and, after proposals from manufacturers throughout the country had been reviewed, a contract was placed with Remler Company, Inc., San Francisco, California. However, it soon became apparent that the grenade would have to be modified in order to improve its functioning.

Representatives from the Research and Engineering Division worked with Remler engineers and developed an improved design. New molds for the plastic components were rushed to completion, and production of both plastic and metal components was commenced. On this initial contract, Remler, in addition to assisting in the re-design, also solved the problem of properly cementing the upper and lower halves of the grenade body. This they accomplished by first scoring the mating surfaces, then coating the mating surfaces with cement and passing the cement-coated halves through an infra-red oven. A second coat of cement was next applied and the halves clamped together and again passed through the oven.

Until the scoring operation was added, difficulty had been encountered in meeting the drop-test requirements of the specification. The Remler Company satisfactorily completed the contract and shipped the plastic and metal components to Edgewood Arsenal for assembly and filling.

Additional negotiated contracts were later awarded to Remler for the plastic components only, and the metal components, together with the packing and filling materials, were obtained from other suppliers in other Chemical Corps Districts. Assembly and filling continued at Edgewood Arsenal.

Procurement Planning followed the actual procurement. In October 1948 a District Planning Schedule was issued under the Industrial Mobilization Program to the San Francisco Chemical Procurement District for the plastic components of the grenade. Responsibility for the overall procurement of the grenade rested with Edgewood Arsenal. Planning was, therefore, conducted with the Remler Company, Inc., which concern agreed to produce the plastic parts in the quantities required in the event of a national emergency. At later date the Munitions Board confirmed the allocation of a sufficient portion of Remler's productive capacity to the Chemical Corps to produce the three plastic components. Planning, in this instance, made use of Remler's first-hand experience in making the plastic parts, and also utilized their knowledge of the functioning of the grenade when assembled with metal parts.

In November 1948 the Procurement Planning responsibility for the grenade was transferred from Edgewood Arsenal to the San Francisco Chemical Procurement District. The basic planning was not changed, i.e., Remler continued as the planned supplier of the plastic components. Edgewood Arsenal accepted a District Planning Schedule for the manufacture of CN Tear Mixture, and other Districts supplied the metal parts and packaging materials.

All previous contracts with Remler had been negotiated contracts. However, in 1950, Chemical Corps Procurement Agency procured 116,000 sets of plastic components by advertising. A new supplier, General Products Corporation, Union Springs, New York was the low bidder and was awarded the contract.

Up to this time all procurement for the Chemical Corps was accomplished by the Chemical Corps Procurement Agency. When the Korean hostilities commenced, the six Chemical Corps Districts were assigned actual procurement duties and contracts were issued by the districts for the first time since 1946.

In January of 1951, the San Francisco Chemical Procurement District was directed to procure 47,300 M25A1 Grenades. The decision was made to procure the end item, assembled and filled with CN Tear Mixture, if possible, from one prime contractor, who would be required to furnish all molds, dies, fixtures, and filling equipment necessary for the production of the item. Any equipment already acquired under the previous Remler contracts was in use on the East Coast or at

CN Filling Plant at the Eldon Manufacturing Company in Los Angeles.
Fig. 3

Edgewood Arsenal. This method of procurement would eliminate separate contracts for the various components and would reduce to a minimum the added expense of conducting inspection at more than one plant. In addition, it would relieve the Arsenal of the filling, assembly and packaging operations. The District decided that a negotiated contract would be the most satisfactory method of procurement. The Eldon Manufacturing Company, Los Angeles, California, was the successful bidder and the contract was awarded in February of 1951. Eldon proposed to make the plastic parts in Los Angeles and assemble, fill and package at Costa Mesa, California. City ordinances prohibited use of air-borne irritants such as CN Tear Mixture within the city limits.

The Eldon Manufacturing Company is a successful west coast manufacturer of plastic and die-cast civilian articles such as cosmetic and jewelry containers and hardware items. The Eldon Company at all times was extremely cooperative and showed desire to contract work for the Government.

This manufacturer, with the help of San Francisco Chemical Procurement District staff, supplied improved molds which eliminated several of the secondary operations on the grenade, body and slider. One of the main improvements resulted in eliminating the scoring operation. To do this, the molds on the upper and lower body halves were sand-blasted, which produced a rough finish on these mating surfaces. When cemented together they readily passed the drop test.

When manufacturing any item, problems always arise; and, another production problem that was encountered and solved involved the arming sleeve. When the safety pin is pulled, the arming spring ejects the arming sleeve and allows the firing spring to drive the slider detonator assembly against the firing pin, causing the grenade to function. The arming sleeves were not ejecting properly, causing a malfunction. The Chemical Corps Inspector and the contractor, after a series of tests and trials, finally determined that by forming a taper on the inside of the skirt of the arming sleeves, it would release properly. A request for a waiver to Materiel Command was granted to deviate from the specification; and, the arming sleeve, tapered accordingly, solved the main problem.

The slider mold was designed to mold the slider to size,

Slider—Detonator Assembly Fixture Grenade, Hand, Riot, CN, M25A1.
Fig. 4

thus eliminating former sawing and sizing operations. The mold also cored the safety pin hole which eliminted a drilling operation. The end item procurement proved successful and the contract was completed in September 1951.

The completed grenades were canned in individual tear-strip cans and then packed fifty each in a wooden shipping container, having a water-proofed Kraft paper liner. This liner was protected from damage by the cans with sections of heavy fiberboard at the top, bottom, sides and ends. Two ammunition-data cards, listing all pertinent data concerning the finished grenades, were placed in each shipping container; the case liner was folded and sealed with waterproof adhesive, and the container lid nailed on. The closed container was then banded with two steel straps, service color marking applied, and the necessary shipping data (nomenclature of contents, date packed, destinations, etc.) stencilled on the top, one side and one end. The completed grenades were ready for shipment to depot storage.

Chemical Corps Standard Inspection Procedures (SIPs)

Fig. 6a
Resident Inspector, Don L. Gardner with the Electronic Timer for Fuse Delay Time.

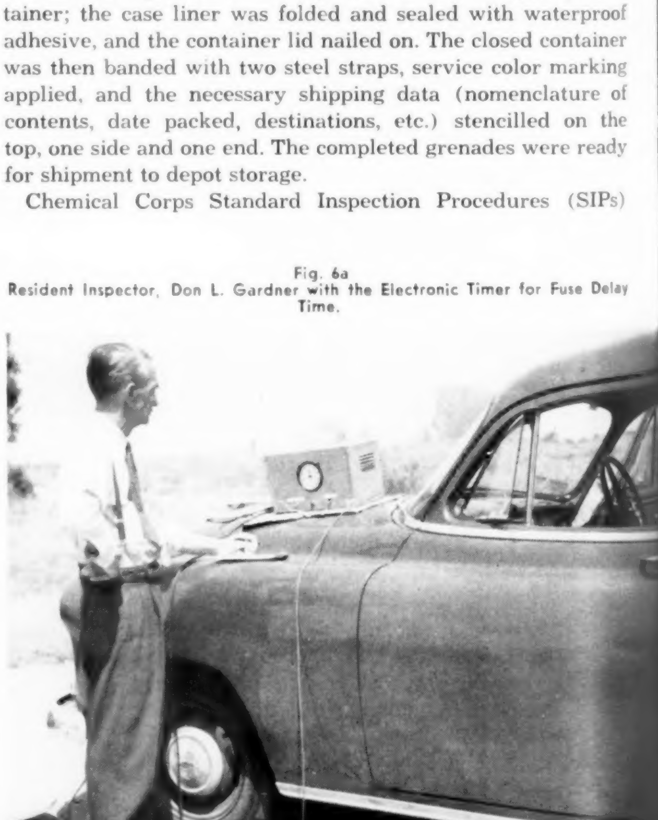


Fig. 5

and Military Standard 105A were used as a guide in determining the acceptability of each item. The SIPs furnish a Classification of Defects (CD) and an Acceptable Quality Level (AQL) value, in percentage, for each defect category. Military Standard 105A and supplement thereto specifies, according to the AQL value, the sample size to be taken from a group or lot of like items and the allowable number of defective pieces or defects per 100 units.

To assure the procurement of items that meet the requirements of the various Chemical Corps Specifications, a resident inspector was stationed at the contractor's plant. The contractor was required to also maintain a suitable "in process" inspection system to assure that the components met the requirements of the Chemical Corps Drawings and Specifications, before submitting them for Chemical Corps inspection.

The specifications required that a pilot or test lot of 200 pieces of each of the components and of the end item be submitted for Chemical Corps inspection when a contractor was, for the first time, supplying a particular item to the Chemical Corps, or when new molds, dies, or manufacturing methods are used. One-hundred percent inspection was performed on the pilot lots to assure that the items met all the requirements and that the molds or dies were dimensionally correct. Thereafter the standard inspection procedure was applied.

Colonel G. W. Dorn, Commanding Officer of the San Francisco Chemical Procurement District Checking the Final Assembly of the M25A1 Grenade at the Eldon Manufacturing Company, Costa Mesa Plant.

After the molding, the grenade body halves were removed from the molds, all excess flash (overflow from the mold) was removed, and after inspection by the contractor, were submitted for Government approval. After acceptance by the Chemical Corps Inspector, the process of assembly began. A special type of cement was applied to the mating sections of the upper and lower halves of the bodies, which were then clamped securely together, placed on an endless conveyor and passed through a controlled temperature oven, (Fig. 1) after which each assembled body was tested for leakage by being immersed in water and 5 PSI air pressure applied internally (Fig. 2). In accordance with the governing specifications, a number of the assembled bodies were filled with talc, flour, or sugar to the required weight and dropped from a a minimum specified height on a cement block as a test for cracking or breakage. Upon succesfully passing this test, the grenade bodies were then filled with the tear gas mixture (Fig. 3), sealed with cemented closure plugs and were ready for the final assembly.

Left: Arming Fixtures and Accessories with Armed Grenades on Conveyor Grenade, Hand, Riot, CN, M25A1.

Below, Left: View of the Launcher from the rear in position to launch the M25A1 Grenade. Right: Side View of the Launcher Prepared for Release of the M25A1 Grenade for Timing Test.

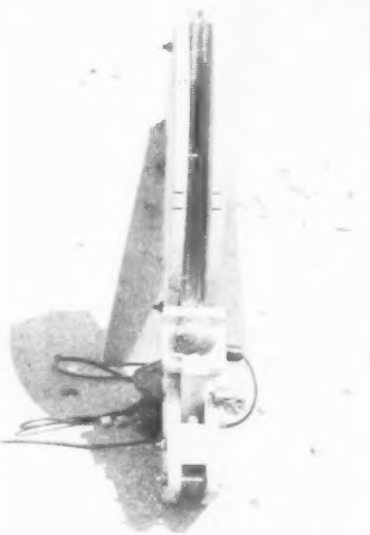


Fig. 6b

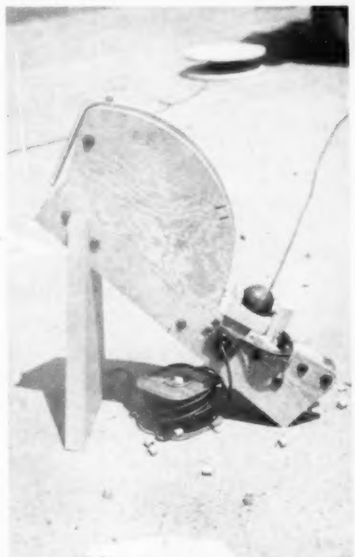


Fig. 6c

The slider was cast of black bakelite and had a cavity in the larger end to receive the detonator (Fig. 4). After casting and deflashing, the sliders were checked dimensionally and for concentricity, using a special fixture dial indicator. The detonators (usually obtained from a cartridge manufacturer) were then cemented into the slider cavities, the flash holes aligned, and the assembled units placed in storage to permit the cement to dry. The final assembly of the grenade was done in an especially designed fixture and was performed numerically to assure that all the components were utilized (Fig. 5). For example: (1) the slider-detonator assembly was placed in the fixture, (2) firing spring placed on slider, (3) grenade body placed over the slider, (4) two safety-balls inserted, (5) arming spring, (6) arming sleeve, (7) safety pin inserted and locked. The grenade was then removed from the fixture, inspected to assure that the safety balls are in

place, after which the firing pin was cemented in position.

The functional testing of the grenade involved the use of a launcher and an electronic timing device. (Figs. 6(a), 6(b) and 6(c). The launcher was a coil spring actuated type on which a micro-switch was located. The micro-switch was connected to the electronic timer, graduated to read in 1/100th of a second. A microphone (also connected to the timer) was placed in the field to pick up the sound of the bursting grenade. The launcher arm was placed in retracted position with a live grenade in the sling, the timer set on zero, the grenade safety pin pulled, and the launcher arm released. The movement of the launcher arm, through the micro-switch, started the timer, and the explosion of the grenade, picked up through the microphone, stopped it. The time recorded was the delay period of the fuse which must be between 1.4 and 3.0 seconds.

Upon the completion of satisfactory functioning tests, the grenades were placed individually in tin cans and sealed. The cans were then immersed for 30 (thirty) seconds in water at a temperature of 180° Fahrenheit. Heating the can in this manner expanded the air which was trapped inside the can and, should there be a leak, the escaping air would cause bubbles to rise to the surface of the water. Should there be any "leakers" the cans could be reprocessed, either by passing them through the sealing machine or by soldering. After leak-testing, the lot number was stencilled on the circumference of the can and the finished item was packed for shipment.

While this complete procurement of the grenade was under production, a further plastic component procurement order was received by the District. In June 1951, Chemical Corps Procurement Agency placed upon San Francisco Chemical Procurement District a requisition for the procurement of approximately 190,000 sets of plastic components for the grenade for shipment to Edgewood Arsenal for assembly. Invitations to Bid were issued to plastic manufacturers throughout the country and contracts were awarded as follows: (a) Body Assembly—Eldon Manufacturing Company, Los Angeles, California, (b) Slider—Watertown Manufacturing Company, Watertown, Connecticut, (c) Firing Pin—General Products Corporation, Union Springs, New York. The contractors were furnished Government-owned molds acquired on the previous contracts. Production commenced and after inspection initial shipments were made to Edgewood Arsenal.

It was then decided by Chemical Corps Materiel Command to transfer the assembly, filling and packaging of 138,000 of the grenades to industry. Metal components, filling materials, containers and packing materials were to be furnished to successful bidder by Edgewood Arsenal and plastic components by San Francisco Chemical Procurement District from the contracts then in production. Eldon Manufacturing Company was the successful bidder and again set up an assembly line at Costa Mesa, California. Components were transferred from Edgewood Arsenal and shipments of plastic components were diverted to Costa Mesa. The chloracetophenone and magnesium oxide were shipped from Edgewood Arsenal to Federal Laboratories, Pittsburgh, Pennsylvania, for micronizing and blending to CN Tear Mixture and subsequent shipment to Costa Mesa. Initial shipments were made in May 1952, and the contract was completed in July 1952. Under the same contract 2,700 Inert Grenades were procured for the Dallas Chemical Procurement District and shipped to Pine Bluff Arsenal for use in Training Set, Inert Ground Chemical Munitions, M11.

Procurement Planning by the District for the grenade has been revised to provide for procurement of the grenade, assembled and filled with CN Tear Mixture, from Eldon Manufacturing Company as was accomplished on the two previous contracts. Planning places on Eldon the responsibility of either manufacturing or purchasing all components or materials for the end item. Critical components only are now scheduled on other districts in order to obtain confirmed allocations of capacity from the Munitions Board in plants which supply the detonator and the CN Tear Mixture.

The foregoing narrative is an example of how Procurement Planning and Procurement was conducted by a Chemical Corps District for one end item, i.e., Grenade, Hand, Riot, CN, M25A1. As is indicated, the Planning was revised to take better advantage of industry's capabilities, and to procure at lower cost to the Government. It is estimated that the savings resulting from procuring the 138,000 assembled grenades from industry on the last contract would cover the cost of operating the district office for approximately one year. Of greater importance, however, is the knowledge that throughout the Chemical Corps Districts similar Procurement Plans are prepared or are in operation for the procurement of all major end items.

A true test of the effectiveness of the entire Industrial Mobilization Program would occur only in the event of a National Emergency requiring all-out production. Nevertheless, we have as a result of the planning, the assurance that suppliers already qualified with "know-how" from production experience, or familiar with items and requirements, are prepared to immediately commence production of Chemical Corps materiel thus reducing production time to the absolute minimum. Time, our most valuable asset, will be saved; and, if World War III comes, the time saved may save us.

This ad appears in the '53 edition of "Career", which has wide circulation among colleges and universities. ("Career" is made up almost entirely of company presentations to solicit new, potential executive personnel.)

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Sincerely yours,

H. H. McIntyre

Vice President
in Charge of Research

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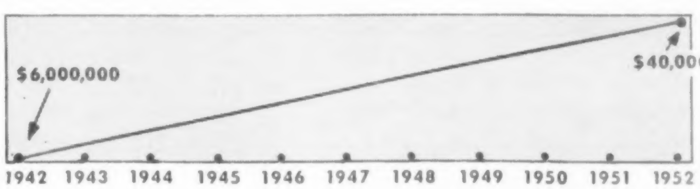


Selecting and Training of the Chemical Procurement Officer

Col. Samuel M. Cummings served with Chemical Warfare troops in World War I, and during World War II as Chief of the Chemical Commodities Division was responsible for the production of the napalm program from December, 1942, when it was inaugurated, until the close of the war. Since then he has been prominent in Chemical Corps Reserve activities, and is presently Senior Officer of CC Mobilization Detachment No. 10.

By COLONEL SAMUEL N. CUMMINGS, Cml.C.

In a recent Washington release, it was stated that professional and scientific men being called into the service by the draft were to receive only half the normal basic Infantry Training, the thinking being that the Army could more quickly take advantage of their professional skills. While this article has to do with the training of the Chemical Officer scheduled for assignment in the Procurement Field, I can state, without hesitation, that this thinking is completely wrong. In substantiation of this stand I merely say, consult the situation maps and casualty lists from North Africa to the Battle of the Bulge right down to Korea. While the writer served in an administrative capacity in the ZI in World War II, he was in battle in World War I. With rare exceptions, no man should be commissioned an officer, unless he has served at least six months as an enlisted man. There have been instances far too numerous to mention where Supply Officers had to man machine guns and Special Service Officers operate a tank or run a smoke generator.

This paper is prepared, not with the intention of firing an editorial bazooka in any direction. It is merely intended to stimulate discussion among Reservists and to encourage those Regular Army Planners, who have already explored this touchy problem, to continue with their work of trying to put the best trained men in the proper jobs.

Constantly we read of the growing demand on the part of Congress for more civilian direction in Army Procurement Agencies. In a sense, the Army itself is largely to blame for this attitude. True some unprincipled Procurement Officers have been responsible for a measure of unfair publicity, but these instances have been so rare that in daily industry they would not receive more than passing notice. American industrialists and manufacturers have never subscribed to the philosophy that any man can do any job. They do not permit their salesmen to maintain the company's intricate accounting system, nor a customer correspondent to supervise their production lines. But that is pretty much what the Army does. The rank on a man's shoulder does not necessarily qualify him for every possible assignment in global warfare. This is particularly true in the case of industrial procurement, labor relations and plant management.

During World War II we had officers with every conceivable background performing or attempting to perform assignments for which they had not the training, aptitude or interest. There were some notable exceptions, but by and large, this fortunate situation did not maintain in all ranks,—and the results were equally unfortunate when on short notice officers with academic, legal or fiscal training but no field training were suddenly ordered from a Procurement District to an overseas troop command.

Our industrial, manufacturing and military operations have become so complex, that it is humanly impossible to expect even the better qualified individuals to master more than one of them in the few short months or years allowed by the impact of a cold or hot war. Our officers must be specialists. Early in the training of an officer it should be decided whether he should be destined for Army administrative work, troop duty or procurement via civilian agencies.

Up until 1940, very little attention was given to such phases of Procurement as sources of raw materials, capabilities of manufacturing plants, dispersal of manufacturing areas, contract negotiations, new item production, end-item inspection and global packing and transportation. As a matter of fact, Army research and development had come up very little since the close of World War I. Most of the school solutions were based on trench or sitting duck warfare. But, with the advent of long-range bombers, and blitzkreig tanks and transportation, the need for a change in our Reserve training became more pronounced.

Were I to attempt to discuss the training of all types of Army Reserve Officers, I would be guilty of the identical errors cited above. Instead I will treat only with the Reserve Officer who is slated for procurement duty in any of the Branches of the Service.

1) Source of future Procurement Officers. They should not be chosen on an alphabetical or serial number basis, but only after a careful, personal interview to determine the individual's inclinations and aptitude. Mistakes made in a Procurement District are very often more costly in lives and dollars than similar snafus overseas. Men who have had prior active service as officers or enlisted men who possess the aptitude for this phase of Army work should be encouraged to apply for Procurement work. Frequently they are again back in civilian life in junior executive positions where their present work would be an asset to any Procurement District. The Army should then make a contract with such a man, that unless he requests field duty or the urgency of the situation requires it, he will not be sent to field duty on short notice. Then it would be possible for him to devote all his energies toward specializing in and keeping up-to-date on military procurement regulations and procedures.

With such a guarantee of future assignments, the Procurement Reservist would spend his weekly or biweekly training sessions attending lectures by top-flight purchasing agents, stock control experts, office management supervisors, as well as economic and natural resources geographers from nearby universities. This type of background training is essential in the light of global warfare. Procurement officers should be trained for overseas procurement of essential and maintenance

items for manufacture and subsistance. They should also know the conditions of climate, temperature, storage, transportation and labor their stateside items will encounter at the point of overseas delivery and use. During World War II, there were several glaring mistakes whereby large items could be transported with difficulty by train or boat, but were impossible of movement by air.

Then, during his summer camp tour, the Procurement Reservist would perform actual on-the-job work at a Procurement District office, or in the offices, factories or plants of industrial concerns holding active Government contracts.

In the case of R.O.T.C. or Service School graduates scheduled for Procurement work, all should have from eight to twelve months of basic soldiering and military operations. Then, before his course is concluded, he should be given short courses in each phase of Military Administration as it affects accounting, Finance, Civil Service Regulations, Contracts, Negotiation, Re-Negotiation and Termination of Contracts, Procurement Regulations, as well as Civilian and Military Control Agencies, to mention but a few of the more prominent. Having been thus given an introduction to the various intricacies of military procurement, the young Reservist could follow up in greater detail those areas which are more applicable when he receives his active duty or Reserve assignment.

Constantly during his training, the Reservist should be advised never to lose sight of the broad overall picture,— victory on the battlefield frequently depends upon victory on the production line. And just as the triumph of the Allies in World War II depended on Joint Operation of air, land and sea, so he should explore and be ready to operate under Technical Service Procurement or Centralized Procurement whereby he would serve as a liaison officer for his particular technical service.

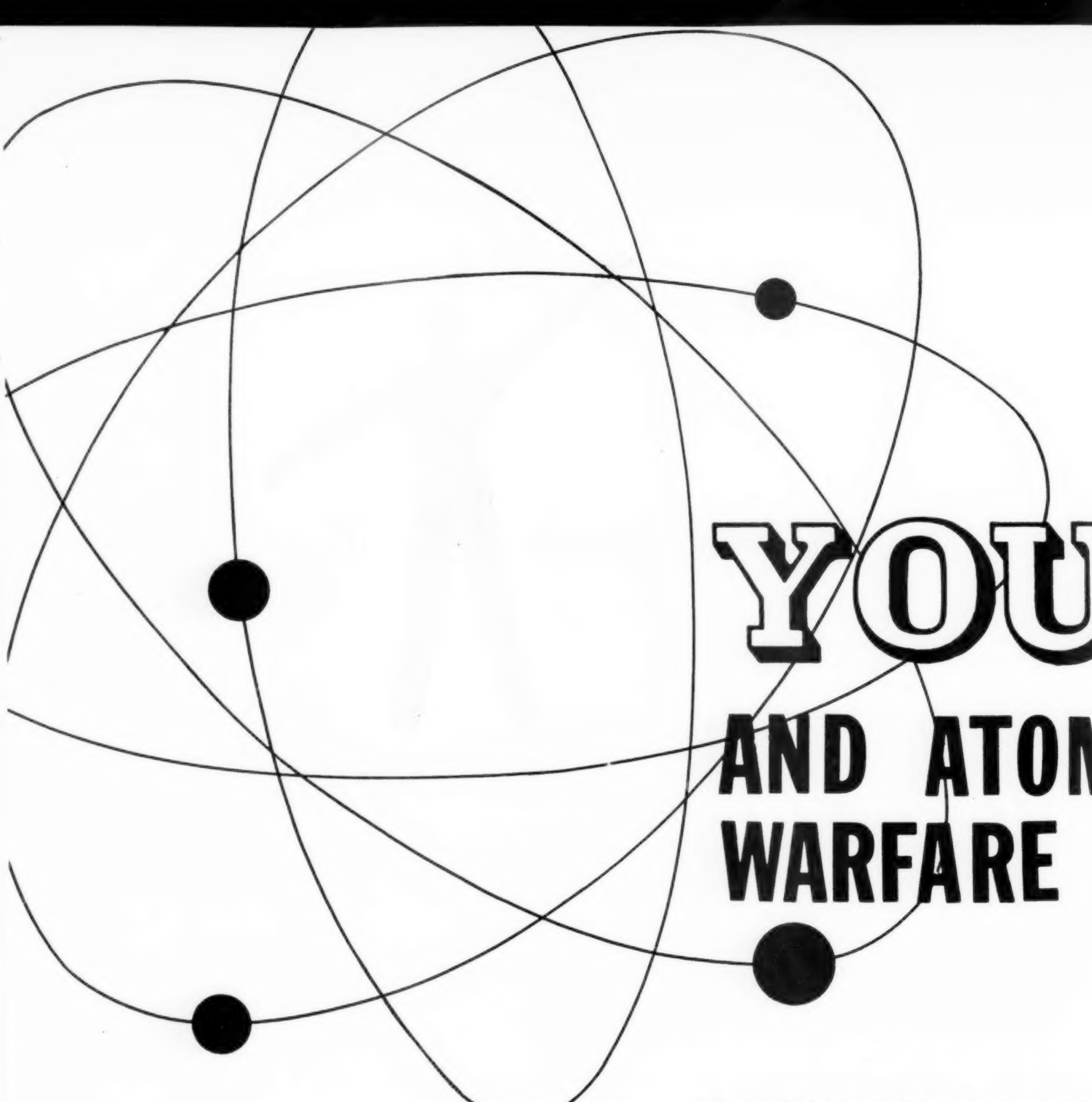
As a further extension of the training of the active Procurement Reservist, consideration should be given to a continuous training program for qualified men and women beyond the draft age, who could assist in staffing key spots in an emergency expanded Procurement District. The physical standards for such individuals could be much lower or waived entirely; there would be no thought of giving them troop assignments in the event they were offered a temporary commission. The records of such individuals would be so marked lest any overzealous Adjutant or an impersonal IBM punch card machine should come up with a different assignment. Here again, greater importance should be placed on the validity of the Government's contract with a specific officer for specific work, in contrast to the prevalent Army policy that an excellent Infantry Officer would make a good contracting officer or enemy prisoner stockade commander. This is one concept of the proper utilization of manpower which must be changed.

While the basic aim in modern warfare remains the same, namely the destruction of the enemy's ability and will to resist, there have been many changes in the methods whereby this aim is to be attained. Furthermore, no modern war has concluded using the same materiel as was available at its inception. I might cite the tank, plane and employment of toxic agents as developing during World War I; with jet planes, fire bombs, flame throwers, proximity and radio fuses, radar and guided missiles as some of the developments in World War II which affected Armies and the operations of those charged with supplying those armies. For example, some 11,000,000 men and women wore the uniform of our

country during World War II, while it is conservatively estimated that in excess of 50,000,000 Americans participated in the conflict by donating blood, filling shells or performing a thousand other tasks which contributed to defeat of the Axis. Thus it becomes clearer that the winning of a modern war depends on several categories of officers; those who are trained in the science of military tactics, strategy and actual combat; those trained in the planning and development, procurement and production of existing and to be devised military materiel and officers skilled in detecting and marshalling the psychological, political, economical, manufacturing and military potential of the Nation.

It is acknowledged that many of the thoughts contained herein are not entirely new. Many of them have been considered. Many of them are still being considered. But until they are genuinely and concertedly acted upon and put into effect from the upper echelons down to the most recently commissioned Second Lieutenant, criticism of the tax-conscious Congressman and tax-paying business man and man-in-the-street will continue to be directed against Military businessmen or Procurement Officers. To go even further, one occasionally hears demands that all military spending be placed in the hands of civilian procurement agencies. Chemical Corps Procurement does not stress shoes and soap and wax but highly technical items which require specialists as their buying agents. For example, in a Montgomery Ward, Sears Roebuck or J. C. Penney operation, specialists buy specialized items; therefore, isn't it logical now, with unification of the services, that Chemical Corps specialists should purchase chemicals for all of the services? This type of program which would allocate specialists to their own field would work out best in the long run for both the government and the manufacturer. An officer trained in Chemical Corps procurement brings to the operation the American concept that a man is entitled to a profit; furthermore he knows from his many years of dealing with American manufacturers that few, if any, are attempting to "put one over" on the government. The trained procurement officer runs his division with the same conscientiousness as does the department head in any business where he is accountable to stockholders. When Chemical Corps officers are properly trained there is no need for highhandedness or bluffing on the part of anyone, but instead, all, the military and industry, work for the common interest. In contrast to a Procurement Agency directed by a capable Army Officer with troop, overseas and combat experience, properly trained in and with an aptitude for business, no array of civilian agencies could do a better or even as good a job.

Based on the writer's personal experience, there is no question but that the military can do the job properly. There is nothing so difficult or mysterious about Procurement. Stripped of all encumbrances, it amounts to this,—"get the right item in the right quanitity to the right place at the right time functioning rightly." The basic machinery exists. What is required is a change in its method of functioning and operators. We do not assign artillery officers to perform medical operations; we do not ask dental officers to demonstrate parachute technique, nor supply officers to handle judge advocate cases. Why then expect just any officer to do a superior job as contracting officer? Sound procurement and proper production are specialized jobs calling for specialists. Therefore, why not train procurement officers in this specialized work and then staff our procurement offices with specialized workers.



YOU AND ATOMIC WARFARE

By HAROLD C. KINNE, JR., Capt. CmlC.

YOU'VE GOT TO LIVE WITH AN ATOMIC BOMB! For the rest of your life, you have to expect that atomic or hydrogen bombs may be used against you on the battlefield, at home, in cities or on farms. At any time, you may come under an atomic attack. You have to learn to fight with it and to protect yourself against its effects in order to survive in this world of ours.

These bombs are terrible weapons, but they do not mean the end of all life as many people think. You can live through an atomic attack, and by taking common-sense precautions, live to fight another day. When any large bomb, such as an A-bomb goes off, there will be an area close to the bomb where, if you are unlucky enough to be there, you're dead beyond any question of a doubt! This area is relatively small, even with 1953 model bombs, and it is a matter of luck whether you are at this spot or not. However, there is a much larger area around this central "ground zero" area where, if you do the wrong thing, you will be killed; but, if you take the proper action, you have a good chance of surviving unhurt. This is the zone where reflex action and proper training can protect you. This is the area where this article can help save your life!

First, let's take a look at the picture you see when a bomb goes off. Even if you have never seen an atom bomb go off, you will recognize it without any trouble if you know what to look for. The first thing that happens when a big bomb goes off is a tremendous flash of bluish-white light. This light is about fifty times as bright as the sun and a lot closer to you. You will immediately know that it was an A-bomb when you see this light. It makes little difference whether it was five or fifty miles away! This light is your first notice that the bomb has been used. It is your "key" that the bomb has exploded and the signal for you to take action to protect yourself.

As soon as the glare fades, you will see a ball of fire at the point where the explosion occurred. This ball will turn from white to orange, to bright red and then begins to be covered by a brown smoky-looking cloud. At night, you may see a blue glow coming out of the top and sides of the ball of fire, which is the same blue you see in a lighted radio tube. This blue glow is caused by the radioactivity of the fireball itself. This brown cloud will rise very rapidly and a "stem" of dust will shoot up from the ground to meet it.

When the blast of the bomb hits the target, it pulverizes the center of the target area. These pieces of the target make up this "mushroom stem" of the explosion. Then, the head of the cloud reaches very cold air and actual ice crystals

form over the top of the cloud as an ice cap. The cloud itself is still hot and churning, so the ice flows down over the sides and is mixed through the cloud to turn it to a pure white color. This white mushroom zooms up to forty or fifty thousand feet and then begins to break up and drift away. The top of the cloud may be several miles in diameter and can be seen from hundreds of miles away. Eventually the cloud drifts off and you can't tell it from other clouds in the sky.

The explosion of an atomic bomb, watched from a safe distance, is one of the most beautiful sights ever seen by the eyes of man. It is truly amazing that anything so beautiful can be so deadly! Just like the beautifully colored coral snake, its bite can be fatal; it is a deadly foe! You may ask "But what is it in this beautiful thing that is so dangerous?" Let's take a look at the explosion and see what can be harmful to us and what we can do about it whether we are in combat or at home. Basically there are only three things to think about: BLAST, HEAT and RADIATION. Let's look at each of these in turn and learn what to do for our protection.

BLAST from an atomic bomb is just like blast from any explosive except it is larger. The wall of air pressure created by this atomic bomb hits and can hurt you and your equipment. You have seen buildings hit by ordinary bombs with the walls unfolded by the explosion like the petals of a flower. This is caused because the blast of an ordinary explosion lasts for such a short time and is followed by suction. The blast hits the building for only a few thousandths of a second and only cracks the walls. Then the suction phase pulls the cracked walls out. However, the A-bomb pushes on a building for about one second, about a thousand times as long as ordinary bombs, and the walls are down before the suction can do its damage. You might say that where ordinary bombs hit a building sharply, the atomic bomb leans on a building until it pushes it over!

This blast itself won't do much damage to you. Doctors say the most you have to worry about is a broken eardrum. They are very rare. There were only about a dozen cases of broken eardrums at Hiroshima, for example. But—this blast wave will pick up anything that moves and throw it at you at hundreds of miles per hour; or, it may pick you up and throw you at a building at the same speed! The way to avoid trouble is to get down flat, down below the surface of the ground if possible, and stay down so that flying debris can go over your head and so that you won't be thrown around like a rubber ball. Remember, a toilet seat at 100 miles per hour is just as dangerous as any machine gun bullet ever made! How long have you got to get down? Once again, it depends on how far away you are when the bomb goes off. The blast, flying debris and sound of the explosion all travel at the same speed, roughly the normal speed of sound. It takes this shock wave four seconds to travel the first mile, then about five seconds for every additional mile. At a mile away, you have better than three seconds from the time you see the white light to get into a hole. Then you'll miss the flying debris problem! You can do it! Many soldiers in combat during the last war and in Korea learned they were in holes at the end of one second which they didn't even see when the artillery went off! If you train yourself to react to the white light of the bomb by falling fast and taking cover, you won't have any trouble from blast.

This business of the blast and sound taking a reasonable length of time to reach you leads to another neat technique of protection against atomic warfare. When you see the white light and start to take cover, begin counting seconds, 1001, 1002, 1003, etc. If the sound took ten seconds to reach you, you were about two miles away. It is as simple as that. This fact is a good thing to know, as you will see when we discuss Radiation.

When the enemy wants to use the blast action of a bomb against us, he will set his bomb off pretty high in the air. This way he uses two blast waves: one directly from the bomb and the other reflected from "ground zero." This reflected wave adds to the original wave in a phenomenon called the "Mach Y-Stem." Even this reinforced shock wave won't cave in foxholes or cause you much trouble if you are below the surface of the ground. If you are too close, there is not much chance. However, if you are over a mile away, the foxhole may well save your life. Beyond about four miles, you don't have a thing to worry about; as a matter of fact, we have had soldiers that close in Nevada and proved it was a safe distance.

Next you will ask "But how about bigger bombs?" We do not know how big the bombs will be that an enemy may use, so what happens then? It is an interesting fact that when you double the size or yield of a bomb, you don't even come close to doubling the distance at which the bomb does damage. The scientist uses a "cube root" relation to determine actual distances. If you want to double the distance for damage, you must make the bomb *eight* times larger. All our figures will hold pretty true for just about any size bomb that might be used against us.

What about the effects of the heat and flash of an atomic bomb? The bomb fireball is originally more than a thousand times as hot as the surface of the sun. It sends out heat like a huge oven. This can and will burn exposed skin and flammable substances like wood and paper. At Hiroshima, this heat was so intense it melted roof tiles near ground zero. This heat comes out from the very first instant of detonation, right along with the white light, and is all over within a few seconds. You may be burned so quickly that you won't be able to get any protection by taking cover. It takes a person about one-half second to react to the blast, about a half second for our brains to tell our muscles "A-Bomb!! Fall flat." In that time we may have at least the start of a good burn. However, at one mile, which is pretty close to "one of these babies," ordinary clothing will protect you from this burn. Keep your sleeves rolled down, wear a hat and keep your fingers crossed for luck. Where you are, and where you are looking may determine what parts of you get burned.

Your next question is probably from how far away can you be burned? Generally you are safe from a burn at four miles or farther from ground zero. However, the weather has a lot to do with burning. If it is a cloudy, rainy, snowy or foggy day, or you are under a smoke screen, you can be a lot closer than you can be on a clear day and still be safe from the heat.

There has been a lot written about blindness from the heat and white light of an A-bomb. It is true that if you are looking directly at the place where the bomb goes off, the white light can cause temporary blindness just like the spots you have in front of your eyes after you have looked at the sun at noontime. But, you are *not* blind. You won't be walking into trees or falling into holes. You may have trouble sighting your rifle for a minute or so. You won't be able to read your watch for a few minutes. After three or four minutes in the daytime, or ten or twenty at night, however, your eye sight is just as good as it ever was. Don't get panicky; don't be afraid of this effect as it is merely temporary. Those of us that have had this flash-blindness have had no permanent damage to our vision.

Most people are afraid of radiation. Radiation is the one new effect obtainable by the use of an atomic bomb. Truthfully, this is the least important of the three effects as far as the soldier on the ground is concerned. The radius of this effect is much less than the distance for damage from blast and heat. It is only in very special situations, where a soldier would be buttoned up in a tank or in a deep bunker, etc., that this radiation effect may be considered. If the average person is close enough to be worried about the radiation

effects of the bomb, he has already been killed several other ways.

Radiation from the bomb comes out in four forms. First there is the alpha particle or nucleus of the helium gas atom, then the beta particle or high speed electron, next the gamma ray or "energetic" X-ray, and the neutron. Of these, only the gamma ray and the neutron have enough range or travel far enough to be considered in effect on the human body. All of these radiations affect the body in a manner similar to X-rays. If enough radiation is received, it can be fatal. From a bomb, however, this fatal amount of radiation can be received only fairly close to ground zero. Distances practically never exceed one mile. Since buildings are destroyed out to two or three miles and burning occurs to three or four miles, this is a short distance.

All of the radiation from an air burst bomb, which is of significance to a military situation, comes out within the first minute and a half after the bomb explodes; one-half in the first second, the remaining half during the next eighty-nine seconds. Ninety seconds after the bomb goes off, the radiation hazard on the ground is over. There is a little radiation left on the ground, enough for the scientists to measure it with instruments, but not enough to hurt you in any respect.

You have all read about the "radioactive snow" that fell in Rochester New York, after a Nevada test. Also the papers have had articles about the site of the first bomb detonation at Almogordo still being measurably radioactive seven years after the burst. The amounts of radiation involved here are far too small to hurt any of us and certainly do not present a military hazard.

These bomb radiations can be stopped by thick substances; steel, concrete and even ordinary dirt affords good protection. One inch of steel is as good as three or four inches of concrete, or about seven or eight inches of dirt, and will cut out nearly half of the radiation you would otherwise receive. If you are in a tank or foxhole, you have very good protection from this burst of radiation. If you stay in the tank or foxhole for ninety seconds until the initial radiation is all over, you have little to worry about radiation. If you are above ground and get into the foxhole at the end of one second, you can miss half the radiation completely. The same action you take to avoid the flying debris will also be your best available protection from radiation.

With your count of seconds from the white light until the sound and shock reached you, you will have a good measure of possible radiation exposure. You do not know whether or not you have been exposed to radiation. You cannot see radiation. You cannot smell it, feel it or taste it. It takes medical tests to determine your exposure. You may be issued film badges or dosimeters to enable the doctor to read your amount of exposure. If no badges have been issued, they can make a good determination through scientific tests. To save yourself worry, and the doctor needless work, count! If your seconds count is less than five seconds, check with a doctor as soon as convenient. If the count is five to ten seconds, you are probably all right, but check with a doctor after the initial rush is over. If your count is over ten seconds, don't bother the doctor; he will be very busy and you have not been exposed. Finally, don't worry about sterility or impotency as a result of an atomic bomb! If you have received sufficient radiation to sterilize you, you are already dead and this is the least of your worries!

So far we have been considering the air burst bomb only. With regard to surface burst or those under ground or under water, these bursts will be used against specific targets and are worthy of our consideration. The change in effects is about the same for all three types. BLAST is greatly reduced in distance even though earth shock and digging a crater may increase damage to underground buildings or bunkers. Except for the underwater burst, a large crater or hole in the ground is formed and anything originally in the crater just isn't there any more. HEAT is greatly reduced with all types. You may be burned only half as far away with the surface burst and there will not be any burning with underground or underwater bursts. RADIATION is increased as these bursts actually contact the earth or water and all four particles can do damage. Here for the first time, radiation may be left over after ninety seconds (called "Residual Radiation") and there may be enough of it to cause casualties. The immediate area around the crater is dangerously radioactive, so don't be a sightseer! There is nothing left there of value or worth seeing anyway. The tons and tons of earth thrown up in the air will also be radioactive. When they fall back to the ground, they may cause dangerous radioactivity to exist up to about ten miles down-wind of ground zero. For this reason, military outfits and civil defense teams have scientific instruments available to locate the radioactive areas. They may tell you to move out of the area for a mile or two. When they do so direct you to move, move right away. The radiation level is high, but if you follow orders, you will be moved out in time to avoid sickness.

Instruments measure radiation in units called "Roentgens." The limit in laboratories, on atomic tests, or in any place where radiation exists, is 0.3 Roentgen every week. In peace-time we play the game very safely by not allowing any one to take much radiation. It actually takes about 600 Roentgen to kill all the people who receive this dose all at once over their entire body. About 400 Roentgen all at once will kill half the people. You must receive a hundred or two before you even begin to get sick. If an actual emergency exists, remember that the maximum dose of 0.3 Roentgen per week is very, very low. You can take many times that amount before you are in any danger. As a final word of caution, many of the instruments used in the Army and by civil defense organizations read Milli-roentgens. A milli-roentgen is one-thousandth of one Roentgen. So these instruments are worthless in determining really dangerous radiation fields but are valuable mainly in peacetime for medical uses.

With any type of burst, one of the big problems is that of panic—blind, unreasoning fear! A panic in any situation is bad. After an atomic burst where thousands of people may be involved, a panic might kill more people than all the other effects put together. These people would be killed needlessly. It is *your* job to prevent panic. Pass the word about the bomb; tell people what it can do and what it cannot do. If people realize that after the blast wave passes and the debris has stopped falling, the damage from the bomb is over—there won't be any panic. You can help prevent panic, and you must prevent it for your own survival.

Well, let's look at the whole picture and see what we have to do to live when you see the white light—when you see your "key" to the fact that an atomic bomb has been detonated:

1. *GET DOWN!* Take cover behind or in whatever is available immediately. You need protection from flying debris as soon as you can get it. If you are deep enough or behind a thick enough wall, you may also get good protection from the second half of the radiation from the bomb.

2. *COUNT UNTIL THE SHOCK HITS!* If you count until the sound and flying debris reach you, you will have a pretty good idea of how far away the bomb was. *Within five seconds,* see a doctor about possible radiation. *Between five and ten seconds,* check with him when convenient, but you are probably OK. *Over ten seconds,* don't worry about radiation. If you count up to fifty seconds and the sound still hasn't reached you, relax—you made it! Then join the rescue squad, fight fires and help control the situation. If you are in combat, be sure to continue with your combat mission. The enemy will undoubtedly follow up and you'll be needed in your combat job.

3. *CHECK YOURSELF!* After the debris has stopped falling, check yourself for cuts and bruises from flying debris. If you have been hurt, standard first aid is the best treatment. The cut or bruise is just like any cut or bruise received in peacetime and no special precautions are required. If you have been burned, standard first aid again is the best treatment. If you have been exposed to radiation, you won't know it. However, by counting the seconds you will be able to tell whether or not medical testing is needed. Carry on with your mission or rescue work and then get tested when the immediate emergency is over. Obey the orders of the monitoring teams or civil defense organization if they tell you to move out of an area.

WHEN THE BOMB GOES OFF, LET THE DEBRIS STOP FALLING, CHECK YOURSELF, THEN GET UP AND GET TO WORK—YOU'LL BE NEEDED!

HAROLD C. KINNE, JR.
Captain, CmlC

TRAINING COMMAND EXPANDS

During the past year the Chemical Corps Training Command has continued to expand in its permanent home at Fort McClellan. The command, which has charge of all training activities for the Chemical Corps, began operating at the Fort in April 1951 and last November broke ground for a permanent installation.

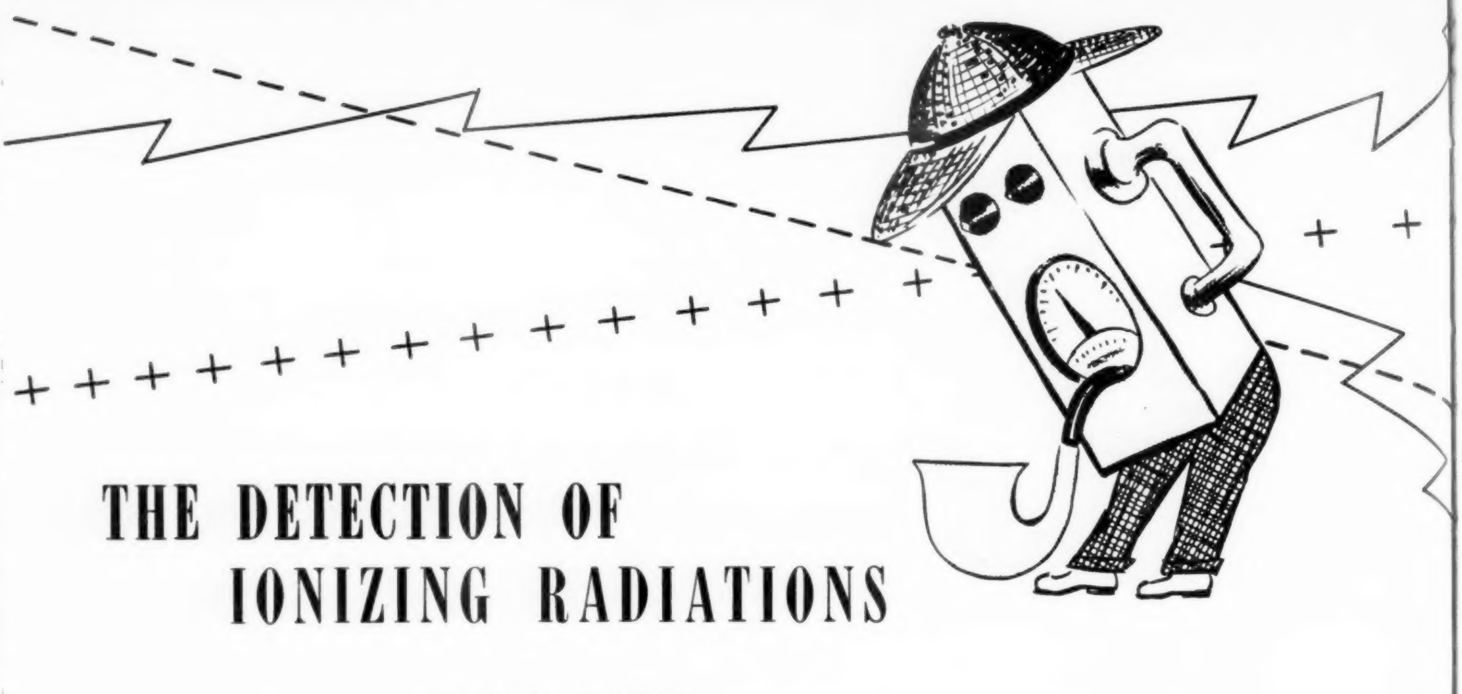
Training is carried on by three units of the Training Command—the Chemical Replacement Training Center, the 100th Chemical Group, and the Chemical Corps School.

Under the program of the Replacement Training Center, men entering the service complete eight weeks infantry training and eight weeks of Chemical Corps training for basic training. The units of the 100th Group learn to work together in operating the various phases of chemical service. At the Chemical Corps School enlisted men and officers of the United States armed forces, as well as selected officers of friendly foreign nations attend advanced courses in chemical warfare and defense.

* * *

QUICKER MASK REPAIR

Soldiers of the Army Chemical Corps' 505th Chemical Maintenance Company at Fort Bragg, N.C., have developed an instrument that more than doubles the rate of testing and repairing gas masks. Masks are inspected by pulling air through the canister to check for air resistance and then subjecting the mask to air pressure to check for face-piece leaks. This formerly involved removal and disassembly of the canister, a process that took at least ten minutes per mask. To speed up the testing, the mask team developed a special jig that permits the testing of the entire mask without removal of the canister. Using the device, the mask testing and repairing team can now check and process more than 1,200 masks in a working day.



THE DETECTION OF IONIZING RADIATIONS

By MILTON C. KURTZ
Munitions Division
Chemical Corps Chemical and Radiological Laboratories
Army Chemical Center, Maryland

When Henri Becquerel discovered the radioactivity of the uranium atom in 1895, he could never have imagined the revolution his discovery would cause. Scientists, their collective curiosities aroused, delved into the mysterious unknown of the atom. This research culminated in the large-scale release of nuclear energy. However, the intensive research behind the release of nuclear energy would have been impossible without the accurate instruments required to detect and measure the ionizing radiations which signal the properties of the atomic nucleus.

All instruments for measuring radiation, other than those using photographic film, and a few other special means, are based on measurement, not of the rays themselves, but of the effects they produce. When a ray of particles, or a ray of energy, enters a gas, it will remove one or more electrons from each electrically neutral atom it strikes. This means that, as the ray proceeds through the gas, it creates pairs of oppositely charged particles—the electrons it removed, and the atoms from which they were removed. These atoms, stripped of one or more electrons are called ions; the process by which they are produced, ionization.

If ionization occurs in the area of an electric field, the positively charged ion will move to the negatively charged electrode while the electrons move to the positively charged electrode. Since each ion or electron carries a charge opposite to the electrode to which it is attracted, the electrode charge is consequently reduced by that quantity.

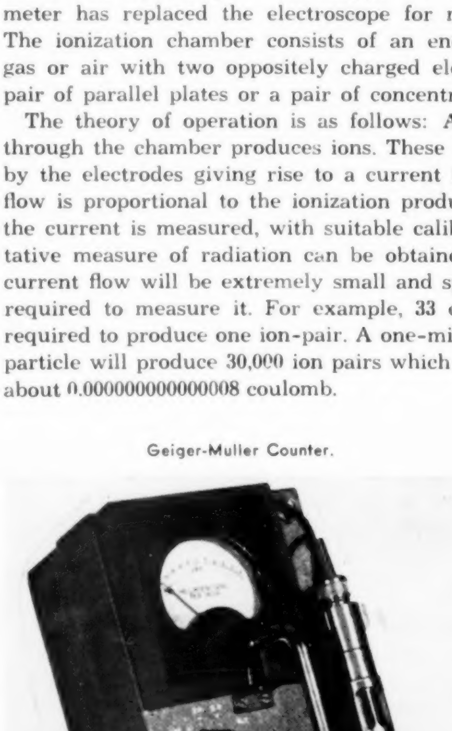
Almost everyone remembers the high school physics experiment involving pith balls, the familiar cat's fur, and glass rod. This experiment demonstrated that like charges repelled one another. This physical fact, that like charges repel one another, is the principle behind the electroscope.

In the electroscope, a known charge is applied to an electrode; the electrode is divided into two segments, one hinged to the other. On charging, these two segments assume the same charge, repel each other, and remain repelled until the charge is removed. Here we have a basis for a simple method for detecting ionizing radiations. If ionizing radiations pass through the air in the vicinity of a charged electroscope, the cumulative effect of the ions on the electrode reduces the charge of the electroscope. This is indicated by the electrodes once again approaching each other.

However, this process is rather slow and requires close observation by the operator. Today, the ion chamber electrometer has replaced the electroscope for most applications. The ionization chamber consists of an enclosed volume of gas or air with two oppositely charged electrodes, either a pair of parallel plates or a pair of concentric cylinders.

The theory of operation is as follows: A particle passing through the chamber produces ions. These ions are collected by the electrodes giving rise to a current flow. The current flow is proportional to the ionization produced, therefore, if the current is measured, with suitable calibration, a quantitative measure of radiation can be obtained. However, this current flow will be extremely small and special devices are required to measure it. For example, 33 electron volts are required to produce one ion-pair. A one-million electron volt particle will produce 30,000 ion pairs which are equal to only about 0.000000000000008 coulomb.

Geiger-Muller Counter.



Portable microammeters can scarcely detect current smaller than one millionth of an ampere; and the best laboratory galvanometers are only sensitive to about one billionth of an ampere. Obviously ordinary current-measuring instruments are inadequate for directly measuring the currents gathered in ion chambers. Therefore, an appropriate electronic circuit must be used to amplify the small current to render it readable. However, an electronic circuit to amplify such a minute current is subject to several ills chiefly because of the small current involved.

To begin, the electrodes of the ion chamber must be well insulated to minimize leakage. The plastics, particularly polystyrene, Teflon, and Kel-F are excellent, in fact, better than amber for this purpose.

The ion chamber instrument can be considered as a condenser in parallel with a potential source with a high input resistor (approximately a million million ohms), and an amplifier tube which must be of a special type, having a very high resistance to the leakage of current.

Now to describe the action of the ion chamber electrometer assume that an ionization chamber is exposed to a constant intensity of radiation, so that the number of ions produced per second is constant. With a low voltage applied to the collecting electrodes, the collection time will be long because of the slow ion movement. With slow ion movement, there will be a recombination of the ions and electrons with a resultant decrease in the current collected. If one raises the potential on the electrodes, a greater percentage of collection occurs before recombination, until a maximum is reached, when all the ions formed are collected. A potential a bit higher than that which produces this saturated condition is desirable since it gives excellent ion recovery and makes the instrument rather insensitive to electrode voltage fluctuations.

The collected current is then fed to the grid of an electrometer triode through a high resistor which is in parallel with the collecting electrodes. The output of the tube feeds into an ammeter which indicates the amplified current. In this manner (with suitable calibration) a rapid, quantitative measure of radiation can be obtained.

However, the ion chamber instrument is most suitable for high levels of radiation and is extremely sensitive to adverse weather conditions which cause erroneous readings because of high leakage.

In the various forms of ionization chambers, relatively weak collecting potenials are used. However, if the electric field is sufficiently strong, the electron from an ion-pair may be sufficiently accelerated to ionize the atoms with which it collides; the electrons so formed produce still more ionization. This chain reaction or multiplication of ionization is called gas amplification. Gas amplification can be obtained either by increasing the electric field strength, by decreasing the energy requirement for ionization by a suitable choice of chamber gas, or by decreasing the pressure of the chamber gas, thereby giving the electrons more time to accelerate before colliding with another atom.

A method which is used to obtain a strong field with moderate voltage uses two concentric cylinders, the inner consisting of a fine wire. This wire is positively charged and strongly attracts electrons to the powerful field in the vicinity of the wire. As a result of gas amplification, the total charge collected may be many times greater than, although it is always proportional to, the original ionization. A detector operating in this manner is called a proportional counter and can discriminate between the primary radiations. The usual gas amplification factor may be anywhere from 100 to 100,000.

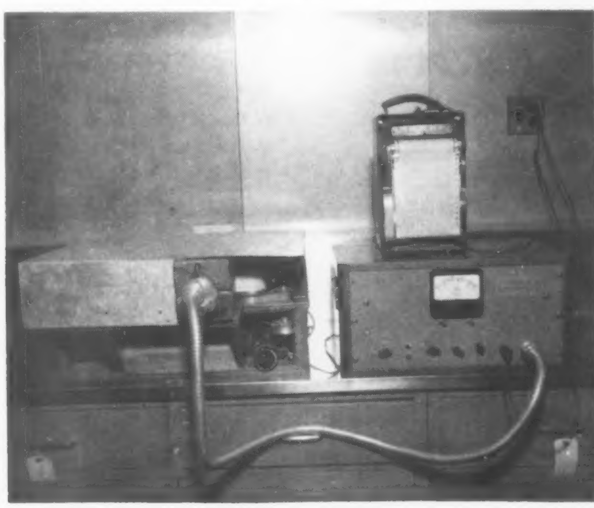
However, in a proportional counter, the gas amplification factor cannot be increased indefinitely because of the appearance of a new phenomenon. If the electric field is increased beyond a certain value, the ion muliplication spreads along the entire sensitive area of the central wire and a continuous discharge takes place. This phenomenon, first observed and evaluated by Geiger, became the basis for the Geiger-Müller counter. It is obvious that the ion current, or pulse, is quite independent of the initial ion-forming radiation, since even a single electron can trigger the discharge inside the tube. G-M counters will therefore count any radiation which will produce at least one ion-pair in the tube. Once the discharge has been initiated, it must be cut off before the tube is able to respond to another ionizing event.

Electronic quenching circuits can be used to cut off or quench the discharge by connecting vacuum tubes so they reduce the counter voltage sufficiently to prevent continuous discharge. A somewhat simpler system, which is desirable in portable instruments, is the self-quenching counter. The self-quenching G-M counter is filled with a mixture of approximately 90% argon and 10% polatomic organic vapor, usually ethyl alcohol, to a pressure of about 10 cm. of mercury.

To understand the action of this system, perhaps it would be wise at this point to describe the sequence of events which occur in the G-M counter. The incident radiation produces several ion-pairs. The electrons are accelerated to the anode wire and in so doing collide with other atomic electrons.

Ion Chamber Electrometer.

Continuous Air Monitor Assembly with Scintillation Counter.



Continuous Air Monitor with Scintillation Counter. RCA 5819 take Photo Multiplier with Anthracene Crystal.

These electrons are knocked loose and in turn are accelerated to the anode wire until the discharge begins with an avalanche of electrons. These electrons move much faster than their corresponding positive ions. The positive ions migrate to the cathode where they pick up an electron and are neutralized. In so doing, the electron goes into a lower energy level and a photon or quantum of light energy (usually in the ultra-violet) is emitted. This photon has sufficient energy to knock an electron from the walls of the counter or elsewhere in the tube which starts the process over again. The overlapping of this phenomenon results in the continuous discharge of the Geiger tube.

To quench this discharge with organic vapors, certain conditions must be met. To be effective, a quenching gas must have an ionization potential lower than that of the main gas in the tube; it must have a good efficiency for absorbing ultraviolet radiation; and when in an excited state, it must dissociate rather than emit radiation.

The quenching action is as follows: The positive ions in an argon-alcohol filled tube will consist of both argon and alcohol ions. Since the argon atom has an ionization potential of about 16 electron volts, and alcohol has an ionization potential of about 11 electron volts, the argon ions on colliding with alcohol molecules are able to transfer to it enough energy to cause it to form an alcohol ion while neutralizing itself back to the argon atom. The excess energy resulting from this transfer (16–11=5 electron volts) is emitted as ultraviolet light which is absorbed by the alcohol molecule. It is not possible for the reverse to take place since the energy of the alcohol ion is below that required to produce an argon ion. Therefore, most of the ions reaching the cathode will consist of alcohol ions. When neutralized by an electron from the cathode, excited alcohol molecules prefer to break up or dissociate rather than emit a photon of light energy. True, some argon ions will reach the cathode, but the ultraviolet emitted when they are neutralized is again absorbed by the alcohol molecules. With no photoelectrons available to initiate or perpetuate a discharge, the action is effectively quenched. The whole process is extremely rapid; for example, only about one-millionth of a second is required for the electrons to be collected while one ten-thousandth of a second is required for the positive ions to reach the cathode. Therefore the G-M counter is capable of counting one ionizing event every ten-thousandth of a second, but in practice is limited by the counting rate of its mechanical accessories.

The organic vapors while very desirable as quenching agents present several difficulties. Since some molecules dissociate with each discharge, the organic vapor is eventually used up. When this occurs of course, the tube becomes useless. Then too, as all organic vapor concentrations are dependent on temperature, the operating characteristics of the self-quenched G-M counters are dependent on temperature. It is therefore desirable to operate them at a constant temperature to assure precision.

Since the shower of electrons reached the central wire in one-millionth of a second, the current is collected as a well-defined surge or pulse. It is of sufficient intensity to cause a click in a set of sensitive headphones. This pulse is fed into an electronic integrating circuit which records the radiation on a meter in counts per minute. One can visualize the principle of operation of this circuit rather easily. Consider the meter itself. If one pulse is fed to the meter, the needle deflects to a certain point and returns. If, however, the pulses are close together before the needle can return, it is again deflected by another pulse. If the radiation is constant and the pulses appear at the meter at a rather constant rate, the needle will reach a state of equilibrium. With suitable calibration, the system can be used as a measure of radiation. Since the G-M counter records individual ionizing events, it is an extremely sensitive instrument. Conversely, since it has a limited counting rate (because of the quenching action and the limitations of the recording machinery) it is unsuitable for use in areas of high-level radiation.

The G-M counter, because it does detect individual ionizing events is particularly valuable in work involving radioisotope-tagged molecules, particularly where a high dilution factor is involved. The G-M counter when connected to a commercial scaler unit is of prime importance in radiochemical research. The commercial scaler unit consists of a stabilized high-voltage supply and an appropriate electronic circuit which gives an absolute count of ionizing events per given time interval.

One of the oldest methods used to detect radiations was to observe the flashes of light given off by certain crystals when subjected to irradiation. These flashes were first used quantitatively by Lord Rutherford who used a phosphor to count the alpha particles emanating from radium. In fact, this type of detector was used to observe the first atomic explosions in Rutherford's famous scattering experiment. While the original idea exists today as a spinthariscope in atomic energy laboratory toys, a successor has been developed which has a good chance to be more satisfactory than any other type of detector for certain applications. Such a detector is called a scintillation counter.

When passing through certain crystals (zinc sulphide, anthracene, or naphthalene to mention a few) rays lose energy rapidly because they are traveling through a dense medium and make many collisions in their path through the crystal. The energy is then expressed as light. If this light is picked up by a phototube, amplified, and recorded on a meter, a measure of radiation is again obtained.

Radiations cause changes in chemical compounds. Perhaps the most practical use of this phenomenon is the use of the photographic plate. While such plates are not very good for the determination of individual particles, they are used to make a permanent record of the total exposure of personnel to radiation. The industrial potential is unlimited, especially in nondestructive testing.

The foregoing presentation can be considered only a general discussion of the principles of radiation detection with a brief description of the events occurring in the various detectors. It is expected that as nuclear technology progresses and becomes an industrial necessity, the radiation detector will become indispensable in plant operations. It is therefore hoped that this article has been valuable to help give an understanding of the basic principles involved in the detection of ionizing radiations.

MAKE SMOKE!

(Continued from page 10)

port area, that the elaborate smoking installations of World War II find their parallel. Consequently, the original purpose for large area screens—the protection of rear area installations—has again assumed major importance.

As World War II produced a generator that surpassed earlier smoke devices, so the Korean conflict has seen the culmination of work on a still more advanced machine, the pulse-jet generator. The light weight and increased efficiency of this generator, as well as its reduced susceptibility to mechanical failure, has materially advanced its usefulness.

The need of and respect for large area screening has not diminished with the Korean conflict. Rather, the opposite is true. United Nations and ROKA troops operate without the advantages of air superiority enjoyed by United States Forces in the later part of World War II. The armies in Korea battle a powerful enemy over terrain equal to the worst of the Italian campaigns. The situation demands cover, and troops are thankful for the command "Make smoke."

CHEMICAL CORPS KEY PERSONNEL

OFFICE OF THE CHIEF CHEMICAL OFFICER

Chief Chemical Officer—Major General Egbert F. Bullene

Deputy Chief Chemical Officer—Brigadier General Charles E. Loucks

Executive Officer, OCCmlO—Colonel DeLancey R. King

Assistant Executive Officer, OCCmlO—Major William Bell, III

Chief Personnel Division—Colonel Norman D. Gillet

Chief, Plans, Training and Intelligence Division—Colonel Hugh W. Rowan

Chief Research and Development Division—Colonel Marshall Stubbs

Chief, Materiel Division—Lt. Colonel Claude J. Merrill

Chief, Administrative Service Office—1st Lieutenant Roger K. Griffin

Comptroller of the Chemical Corps—Lt. Colonel Robert E. Stoever

Legal Advisor—Lt. Colonel Herbert K. Greer

Chief Technical Liaison Office—Captain Earle J. Townsend

Chief, Safety Office—Major Ned S. Weathers

ARMY CHEMICAL CENTER, MARYLAND

HEADQUARTERS

Commanding General—Brigadier General William E. Creasy

Vice Commander—Colonel Frederick W. Gerhard

Deputy Vice Commander—Colonel James M. McMillin

FIELD OFFICE, CHIEF CHEMICAL OFFICER

CHEMICAL CORPS BOARD

President—Colonel Ralph C. Benner

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CmlC Inspector General—Colonel Russell W. Dodds

OFFICE OF THE SENIOR SCIENTIFIC ADVISOR

Adm. and Liaison Officer—Lt. Colonel John A. Bacon, Jr.

OFFICE OF THE PROVOST MARSHAL

CmlC Provost Marshal—Lt. Colonel Carl E. Grimsley

CHEMICAL CORPS MATERIEL COMMAND

HEADQUARTERS

Commanding General—Brigadier General Henry M. Black

Deputy Commander—Colonel Harold Walmsley

ARMY CHEMICAL CENTER INSTALLATIONS

Edgewood Arsenal

Commanding Officer—Colonel David Armitage

Eastern Chemical Depot

Commanding Officer—Colonel John P. Youngman

Inspection Equipment Agency

Commanding Officer—Captain Paul H. Koenig

Chemical Corps Procurement Agency

Commanding Officer—Lt. Colonel Harry C. Gilbert

Technical Escort Detachment

Commanding Officer—Colonel Garland M. White

PROCUREMENT DISTRICTS

Atlanta Chemical Procurement District, Atlanta, Georgia

Commanding Officer—Captain Alvin H. Bowles

Boston Chemical Procurement District, Boston, Massachusetts

Commanding Officer—Colonel Dominic J. Chiminiello

Chicago Chemical Procurement District, Chicago, Illinois

Commanding Officer—Colonel Victor C. Searle

Dallas Chemical Procurement District, Dallas, Texas

Commanding Officer—Lt. Colonel Hans S. Bendixen

PROCUREMENT DISTRICTS

New York Chemical Procurement District, New York, New York

Commanding Officer—Colonel Joseph F. Escude

San Francisco Chemical Procurement District, Oakland, California

Commanding Officer—Colonel George W. Dorn

DEPOTS

Deseret Chemical Depot, Tooele, Utah

Commanding Officer—Colonel John D. Tolman

Midwest Chemical Depot

Asst. for Depot Operations—Lt. Colonel Edwin A. Limbaugh

Atlanta General Depot, Atlanta, Georgia

Section Chief—Lt. Colonel Virgil A. Willson

Memphis General Depot, Memphis, Tennessee

Section Chief—Lt. Colonel Carl E. Grant

New Cumberland General Depot, New Cumberland, Pennsylvania

Section Chief—Major Alva G. Bearden

San Antonio General Depot, San Antonio, Texas

Section Chief—Lt. Colonel Gail A. Eaton

Utah General Depot, Ogden, Utah

Section Chief—Major Carlos L. Byers

ARSENALS

Pine Bluff Arsenal, Arsenal, Arkansas

Commanding Officer—Colonel John J. Hayes

Rocky Mountain Arsenal, Denver 2, Colorado

Commanding Officer—Colonel Adam W. Meetze

CHEMICAL CORPS RESEARCH AND ENGINEERING COMMAND

HEADQUARTERS

Commanding General—Brigadier General William M. Creasy

Deputy Commander—Colonel William R. Currie

ARMY CHEMICAL CENTER INSTALLATIONS

Edgewood Proving Ground

Commanding Officer—Colonel William C. Hammond, Jr.

Chemical Corps Chemical and Radiological Laboratories

Commanding Officer—Colonel Fred J. Delmore

Chemical Corps Medical Laboratories

Commanding Officer—Colonel Milward W. Bayliss

Chemical Corps Engineering Agency

Commanding Officer—Colonel Clifford L. Sayre

OTHER INSTALLATIONS

Camp Detrick, Frederick, Maryland

Commanding Officer—Lt. Colonel John W. Fitzpatrick

Dugway Proving Ground, Tooele, Utah

Commanding Officer—Colonel Donald H. Hale

Fort Terry, New York

Commanding Officer—Lt. Colonel Don L. Mace

CHEMICAL CORPS TRAINING COMMAND

HEADQUARTERS

Commanding Officer—Colonel John R. Burns

Deputy Commander—Colonel Richard R. Danek

OVERSEAS THEATER CHEMICAL OFFICERS

FECOM—Colonel Jacquard H. Rothschild

EUCOM—Colonel Ragnar E. Johnson

USFA—Major Kermit J. Wilson

TRUST—None

USARCAR—Colonel George R. Oglesby

USARAL—Lt. Colonel Claude W. White

USARPAC—Lt. Colonel James R. Chapman

US ARMY SECTION JBUSMC—Lt. Colonel Albert B. Delmonte

GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

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Aerial Products. Inc., Elkton, Md.
Affiliated Gas Equipment, Inc., Cleveland, Ohio
Air Reduction Company, Inc., New York, N. Y.
Allen Manufacturing Company, Inc., Nashville, Tenn.
Allied Chemical & Dye Corporation, New York, N. Y.
American Aniline Products, Inc., New York, N. Y.
American Cyanamid Company, New York, N. Y.
American Stove Company, St. Louis, Mo.
American Zinc, Lead & Smelting Company, St. Louis, Mo.
Ampco Metal, Inc., Milwaukee, Wisc.
Armour & Company, Chicago, Ill.
Armstrong Cork Company, Lancaster, Pa.
Atlas Powder Company, Wilmington, Del.
Baker & Company, Inc., Newark, N. J.
Bastian-Blessing Company, The, Chicago, Ill.
Bastian-Morley Company, Inc., LaPorte, Ind.
Bechtel Corporation, San Francisco, Calif.
Blaw-Knox Construction Company, Pittsburgh, Pa.
Blickman, S., Inc., Weehawken, N. J.
Bowser, Inc., Chicago, Ill.
Bridgeport Brass Company, Bridgeport, Conn.
Bristol-Myers Company, New York, N. Y.
Brown Company, Berlin, N. H.
Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y.
Canfield, H. O., Company, The, Bridgeport, Conn.
Casco Products Company, Bridgeport, Conn.
Celanese Corporation of America, New York, N. Y.
Central Foundry Company, The, Newark, N. J.
Chamberlain Corporation, Waterloo, Iowa
Chicago Electric Manufacturing Co., Chicago, Ill.
City Chemical Corp., New York, N. Y.
Continental Oil Co., Ponca City, Okla.
Crown Can Company, Philadelphia, Pa.
Curtis Industries, Inc., Helene, Chicago, Ill.
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
Dunham, C. A., Co., Chicago, Ill.
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Eaton Manufacturing Company, Cleveland, Ohio
Empire Stove Company, Belleville, Ill.
Ethyl Corporation, New York, N. Y.
Evans Research & Development Corp., New York, N. Y.
Federal Cartridge, Minneapolis, Minn.
Federal Laboratories, Inc., Pittsburgh, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland, Ohio
Firestone Industrial Products Div., Fall River, Mass.
Fisher Price Toys, Inc., East Aurora, N. Y.
Fisher Scientific Co., New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Calif.
Foster Wheeler Corporation, New York, N. Y.
Fram Corporation, Providence, R. I.
Fraser & Johnston, San Francisco, Calif.
Gasket, Packing & Specialty Co., Inc., New York, N. Y.
Gates Rubber Co., The, Denver, Colo.
General Aniline & Film Corporation, New York, N. Y.
General Dyestuff Corporation, New York, N. Y.
General Tire & Rubber Company, The, Wabash, Ind.
Glyco Products Company, Inc., Brooklyn, N. Y.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Goodyear Tire & Rubber Company, Akron, Ohio
Gray Stamping & Manufacturing Co., Plano, Ill.
Greer Hydraulics, Inc., Brooklyn, N. Y.
Gulf Oil Corporation, Pittsburgh, Pa.
Haertel, Walter, Company, Minneapolis, Minn.
Hamilton Manufacturing Corporation, Columbus, Ind.
Handy & Harman, New York, N. Y.
Harshaw Chemical Company, The, Cleveland, Ohio
Harvey Machine Co., Inc., Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Heyden Chemical Corporation, New York, N. Y.
Hooker Electrochemical Company, Niagara Falls, N. Y.
Howell Company, The, St. Charles, Ill.
Hyman, Julius & Company Div., Denver, Colo.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Nickel Co., Inc., New York, N. Y.
International Salt Co., Inc., Scranton, Pa.
International Silver Company, Meriden, Conn.
Jefferson Chemical Company, Inc., New York, N. Y.
Kilgore, Inc., Westerville, Ohio
Kold-Hold Manufacturing Company, Lansing, Mich.
Koppers Company, Inc., Pittsburgh, Pa.
Kwikset Locks, Inc., Anaheim, Calif.
LaBelle Industries, Inc., Oconomowoc, Wisc.
Lambert Pharmacal Company, St. Louis, Mo.
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Mathieson Chemical Corporation, Baltimore, Md.
Merck & Company, Inc., Rahway, N. J.
Metal & Thermit Corporation, New York, N. Y.
Milwaukee Stamping Co., Milwaukee, Wisc.
Moe Light, Inc., Ft. Atkinson, Wisc.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Monsanto Chemical Company, St. Louis, Mo.
Mundet Cork Corporation, New York, N. Y.
National Fireworks Ordnance Corp., West Hanover, Mass.
Nesco, Inc., Milwaukee, Wisc.
Niagara Alkali Company, New York, N. Y.
Niagara Blower Co., New York, N. Y.
Nopco Chemical Co., Inc., Harrison, N. J.
Oldbury Electro-Chemical Co., Niagara Falls, N. Y.
Olin Industries, Inc., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Parsons, Ralph M., Company, The, Los Angeles, Calif.
Pemco Corporation, Baltimore, Md.
Penick, S. B., & Company, New York, N. Y.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Pfister Chemical Works, Inc., Ridgefield, N. J.
Pfizer, Chas. & Company, Inc., Brooklyn, N. Y.
Philco Corporation, Philadelphia, Pa.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Rau Fastener Co., The, New York, N. Y.
Ric-wiL Company, Cleveland, Ohio
Rohm & Haas Company, Philadelphia, Pa.
Rowe Manufacturing Company, Whippany, N. J.
Rudy Manufacturing Co., Dowagiac, Mich.
Shea Chemical Corp., Baltimore, Md.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Sherwin-Williams Company, The, Cleveland, Ohio

Companies listed in bold face type are Sustaining Members

Shwayder Bros., Inc., Denver, Colo.
Snell, Foster D., Inc., New York, N.Y.
Sprague Electric Company, North Adams, Mass.
Standard Oil Company (Indiana), Chicago, Ill.
Standard Oil Development Co., New York, N.Y.
Standard Products Company, The, Cleveland, Ohio.
Stauffer Chemical Company, New York, N.Y.
Stewart Die Casting, Chicago, Ill.
Sun Oil Company, Philadelphia, Pa.
Tennessee Eastman Corporation, Kingsport, Tenn.
Texas Company, The, New York, N.Y.
Unexcelled Chemical Corp., Cranbury, N.J.
Union Carbide & Carbon Corp., New York, N.Y.
United Carr-Fastener Corp, Cambridge, Mass.
United States Rubber Company, New York, N.Y.
Universal Match Corp., Ferguson, Mo.
Victor Chemical Works, Chicago, Ill.
Vulcan Cupper & Supply Co., The, Cincinnati, Ohio.
Wallace & Tiernan Products, Inc., Newark, N.J.
Westvaco Chemical Division, New York, N.Y.
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.
Zaremba Company, Buffalo, N.Y.
Zenith Plastics Company, Gardena, Calif.

Companies listed in bold face letters are Sustaining Members

BIBLIOGRAPHY

A suggested bibliography on Chemical Warfare for those who want to find out what has happened in the past and who wish to keep up with current developments. This list was prepared by Dr. Leo Brophy, of the Historical Office of the Chief Chemical Officer, at Army Chemical Center.

Addison, James Thayer—**The Story of the First Gas Regiment.** Houghton, 1919.

Chemical Corps Association—**The Chemical Warfare Service in World War II.** Reinhold Publishing Corporation, 1948.

Crowell, Benedict—**American Munitions.** GPO, 1919. Discusses problems of production, including those dealing with gas warfare.

Federal Civil Defense Administration—**What You Should Know About Biological Warfare.** GPO, 1951. (Pamphlet.)

Fisher, George J. B.—**Incendiary Warfare.** McGraw-Hill, 1946.

Fries, Amos A. and West, Clarence J.—**Chemical Warfare.** McGraw-Hill, 1921.

Gilchrist, Harry L. and Matz, Philip B.—**The Residual Effects of Warfare Gases.** GPO, 1933.

Ireland, Merritte W. (Editor)—**History of Medical Department of the United States Army in the World War, Vol. XIV.** GPO, 1926.

Prentiss, Augustin M.—**Chemicals in War.** McGraw-Hill, 1937.

Vedder, Edward B.—**Medical Aspects of Chemical Warfare.** Williams and Wilkins Co., Baltimore, 1925.

Waitt, Alden H.—**Gas Warfare.** Duell, Sloan and Pearce, New York, 1942.

Planned Publications: The Historical Office of the Office of the Chief Chemical Officer is scheduled to publish three volumes on the history of the Chemical Corps (then Chemical Warfare Service) in the overall History of the United States Army in World War II. These volumes will probably appear within the next 18 months. The titles of these volumes are as follows:

Volume I, Part I—Organization, Administration and Personnel Management. Part II—Training for Chemical Warfare.

Volume II, Part I—Research and Development. Part II—Procurement and Supply.

Volume III—The CWS Overseas.

The Historical Office has also published the following historical studies:

No. 1—Smoke Generator Operations in the Mediterranean and European Theaters of Operations. (Restricted)

No. 2—History of German Chemical Warfare in World War II. Part I—Military Aspect. (Restricted)

No. 4—Portable Flamethrower Operations in World War II. (Restricted)

No. 5—Mechanical Flamethrower Operations in World War II. (Restricted)

The principal depositories for Chemical Corps documents are:

Chemical & Radiological Laboratories Library, Army Chemical Center.

Historical Office, OC Cml O, Army Chemical Center.

The Chemical Corps School Library, Fort McClellan, Ala.

The following classified monographs of history of Research and Development of CWS in World War II, prepared by members of the Chemical & Radiological Laboratories, have been printed or are in preparation:

**Vol 7—Charcoal
*Vol. 11—Detectors and Gas Alarms
*Vol. 12—Colored Smokes
*Vol. 13—Field Laboratories and Manuals
*Vol. 15—Flame Throwers
**Vol. 16—Starters
**Vol. 17—Gas Masks
**Vol. 18—Incendiaries
*Vol. 19—Insecticides, Rodenticides, and Miticides
**Vol. 21—Sabotage Devices and Destruction of Documents
**Vol. 22—Screening Smokes

* Printed
** In preparation

As will be noted, Dr. Brophy is in process of completing a definitive history of Chemical Warfare in World War II, and consequently would be interested in receiving interesting contributions from Chemical Corps military personnel.

SOLDIERS AND SCIENTISTS

(Continued from page 18)

support of Army forces. But the important thing is that we have the gun *now*. We want our field commanders to have the capability of being able to use atomic explosives safely and accurately in darkness or in bad weather.

Closely allied with our progress in atomic artillery is our advance in guided missiles, not only the antiaircraft type but the artillery type—surface-to-surface. These missiles can carry either conventional explosives or an atomic warhead. Their all-weather characteristic is most vital to Army operations in the field and their great range makes them capable of hitting any part of an entire corps front. Recent tests indicate that we will have such missiles in the hands of our soldiers in the not-too-distant future. The development of guided missiles, particularly when combined with our progress in atomic weapons, is a tremendous step towards a truly modern Army ready to contribute a formidable defense to the free world.

Today, with so many advances being made in the mechanical tools of war, there is a tendency on the part of some to overemphasize the importance of machines and to underestimate the importance of man. But the true value and importance of these tools to defend our freedom depend finally upon the skill, the courage and the conviction of the men who use them. Men will always be more important than machines, and on the battlefield men will always determine the issue.

Equal attention is therefore being given to problems of human relations and leadership. Science and industry advance into new eras but each generation must learn anew the strengths, the weaknesses and the limitations of men. If we—soldier and civilian alike—can devote more and more effort to the study of man himself, we will ensure that our material gains will benefit man, not destroy him.

M/SGT TUCKER RETIRES

ARMY CHEMICAL CENTER, MD.:—Master Sergeant Oscar L. Tucker, a veteran of thirty-one years' service in the Army, was honored at an informal retirement ceremony in the office of the commanding general of the Army Chemical Center (Maryland) Brig. Gen. William M. Creasy.

General Creasy congratulated the sergeant upon completion of his long and honorable service and presented him with a letter of commendation.

M/Sgt. Tucker who entered the Army in 1922 has served at various military installations throughout the country and has seen overseas duty twice. From 1926-28 he was stationed in the Philippines and in 1943-45 he served in the Asiatic-Pacific Theater.

In addition to a number of service ribbons, he is the holder of the Good Conduct Medal.

Sergeant Tucker's wife, Gertrude, is a resident of Plattsburg, New York.

NEW EYE TREATMENT

Experiments by the Army Chemical Corps with the so-called nerve gases, first developed by the Germans in World War II, have resulted in a new treatment for glaucoma, hardening of the eyeball which frequently causes blindness.

YOUNG, BUT OLD

One of the youngest of the Army's technical services, the Chemical Corps works in a field that apparently had its warfare origin in India about 2,000 B.C. Historical accounts of that time refer to smoke screens, incendiaries and fumes that caused slumber or "prolonged yawning."

SPECIALISTS

(Continued from page 21)

nique. The demonstrations put on with the mines and throwers markedly impress the infantrymen-students with the weapons' potential.

Battle reports indicate that the North Koreans and Chinese are equally impressed.

Sometimes Simpson and other "Deacons" from 21st teams along the front go forward to Infantry units in the line to consult the men who actually put the napalm to the test.

Chemical Corps soldier Simpson is philosophical about the deadly jelly and although he will admittedly be happy to go back to mixing acetate for du Pont this spring when he rotates, he said, "If it takes napalm to get them out of those bunkers, we can provide all they need."

FITZPATRICK NEW C.O. AT DETRICK

Lt. Col. John W. Fitzpatrick, Chemical Corps, assumed command of the post at Camp Detrick, March 1. He succeeds Lt. Col. Michael R. DeCarlo, reassigned to the Biological Laboratories. Col. Fitzpatrick was formerly commanding officer of the Edgewood Proving Ground, Army Chemical Center. He is a graduate of Penn State, class of '25, and the University of Wisconsin, class of '26. He and Mrs. Fitzpatrick will reside on the post. They have two daughters, Mrs. Charles N. Grant, of Chisholm, Minn., and Mary F., a sophomore at Penn State. From 1945 until 1948, Col. Fitzpatrick served in the Philippines and Japan.

CHEMICAL CORPS UNITS CITED FOR KOREAN SERVICE

THE HEADQUARTERS & HQRS. DETACHMENT, 4th C. S. G. BN.

68TH CHEMICAL SMOKE GENERATOR COMPANY

92ND CHEMICAL SERVICE COMPANY

401ST CHEMICAL TECH. SERVICE INTELLIGENCE

Four more units of the Army Chemical Corps recently received official praise for their outstanding performance in Korea. One of these was the 4th Chemical Smoke Generator Battalion's Headquarters and Headquarters Detachment, under the Battalion leadership of Lt. Col. Arent O. Wiken, succeeded during the cited period first by Lt. Col. John L. Carson and then by Maj. William A. Williams. The others were the 68th Chemical Smoke Generator Company, commanded by Capt. Buford B. A. Semmes; the 92nd Chemical Service Company, led by Capt. Alex R. Garrett, Jr.; and the 401st Chemical Technical Service Intelligence Detachment, under Capt. Waddy T. Burnham, Jr.

Besides stirring a warm feeling of parental pride within the Corps, these citations illustrate the broad scope of Corps activities in the battle zone. The adaptability of these units to changing battle conditions typifies the ingenuity which has long been identified with the best tradition of the Corps.

The four Meritorious Unit Commendations (published in Department of the Army Regulations No. 103, dated 24 November 1952) read as follows:—

"The Headquarters and Headquarters Detachment, 4th Chemical Smoke Generator Battalion, is cited for exceptionally meritorious conduct in the performance of outstanding services in support of combat operations in Korea during the period 1 January to 31 July 1952. This small detachment successfully overcame tremendous obstacles to carry out difficult missions normally requiring the services of a full headquarters company. Because of the involved tactical situation, the battalion was divided into separate units which were located at diversified points. As a result of the widespread area over which the battalion operated the detachment was faced with seemingly insurmountable administrative problems. Undaunted by the complexity of the situation, the members of this detachment performed their duties with the utmost enthusiasm and resourcefulness, earning for themselves a reputation for unwavering efficiency worthy of the closest emulation. The Headquarters and Headquarters Detachment, 4th Chemical Smoke Generator Battalion, displayed such laudable effectiveness in accomplishing its mission under the most adverse conditions as to set it apart from and above other units having similar missions. The exceptional administrative skill, assiduity, and tireless devotion to duty exhibited by the members of this detachment reflect great credit on themselves and the military service of the United States." (General Orders 503, Headquarters, Eighth United States Army, Korea, 30 August 1952.)

"The 68th Chemical Smoke Generator Company is cited for exceptionally meritorious conduct in the performance of outstanding services in support of combat operations in Korea during the period 1 January to 30 June 1952. Responsible for providing passive air defense for the port of Pusan and surrounding installations, this company carried out its mission in a superior manner while simultaneously providing direct support for front-line combat units. Displaying ingenuity, outstanding ability, and constant determination of purpose, its members successfully accomplished missions normally performed by units of more than twice the company's size. The technical skill and high standard of efficiency displayed by this company earned it the respect and admiration of all those having knowledge of its fine work and materially furthered the cause of the United Nations in Korea. The 68th Chemical Smoke Generator Company displayed such outstanding devotion to duty in the performance of exceptionally difficult tasks as to set it apart from and above other units having similar missions. The dependability, esprit de corps, and skilled and enthusiastic approach to seemingly insolvable problems displayed by the members of this company reflect great credit on themselves and the military service of the United States." (General Orders 546, Headquarters, Eighth United States Army, Korea, 15 September 1952.)

"The 92nd Chemical Service Company is cited for exceptionally meritorious conduct in the performance of outstanding services in support of combat operations in Korea during the period 1 January to 30 June 1952. Responsible for the operation of a chemical depot, complete with maintenance section, depot section, and field laboratory in direct suport of I Corps and units in the Seoul area, the members of this company consistently carried out their multifarious duties in a manner which elicited the highest possible praise from all those cognizant of their fine work. In addition, subsequent developments necessitated the establishment of numerous branch depots, which were operated with the same high standard of efficiency that had become the trade-mark of the parent unit. Through the diligent application of their wide variety of skills and their constant and uncompromising devotion to duty, the members of this company were able to solve problems seeming to offer no solution. Despite the unprecedented magnitude of this company's task, which eventually included the supply of all class II, IV, and V chemical supplies to the entire Korean front, each mission was met by its personnel with the utmost enthusiasm and resourcefulness and carried out with a promptness and precision that earned them a reputation for unvarying excellence, which is worthy of the closest emulation in all future campaigns. The 92nd Chemical Service Company displayed such outstanding devotion to duty in the performance of exceptionally difficult tasks as to set it apart from and above other units with a similar mission. The outstanding technical skill, ingenious utilization of available fa-

cilities, and esprit de corps exhibited by the members of this company reflect great credit on themselves and the military service of the United States." (General Orders 397, Headquarters, Eighth United States Army, Korea, 25 July 1952.)

"The 401st Chemical Technical Service Intelligence Detachment is cited for exceptionally meritorious conduct in the performance of outstanding services in support of combat operations in Korea during the period 22 March to 27 September 1952. By interrogating prisoners of war, studying captured material, and translating captured documents, this detachment collected vital intelligence information pertaining to chemical, biological, and radiological warfare. Through the skilled evaluation and collation of technical evidence, its members obtained and disseminated valuable information pertaining to the enemy's training, equipment, and capabilities for defense and offense. Although it was already operating over an area much larger than that expected of a unit of its size, the detachment assisted in training United Nations personnel in chemical, biological, and radiological defense while carrying out its normal duties in a superior manner. Displaying determination, outstanding technical skill, and a willingness to assume additional responsibilities, the members of this detachment earned the respect and admiration of all those having knowledge of their work and materially furthered the cause of the United Nations in Korea. The 401st Chemical Technical Service Intelligence Detachment displayed such outstanding devotion to duty in the performance of exceptionally difficult tasks as to set it apart from and above other units with similar missions. The outstanding ability, esprit de corps, and constant resourcefulness exhibited by the members of this detachment reflect great credit on themselves and the military service of the United States." (General Orders 595, Headquarters, Eighth United States Army, Korea, 3 October 1952.)

NEW YORK IN THE SPRINGTIME

(Continued from page 5)

the Circle Line cruise around Manhattan Island? A comfortable yacht leaves the foot of West 42nd Street three times each day for a three-hour sail you'll never forget. Veteran New Yorkers will tell you that there's no better—nor more comfortable way to see the New York Skyline, the Goddess of Liberty, the great bridges to Brooklyn and New Jersey.

Did you know that the New York municipal ferry to Staten Island offers you the world's longest boatride for a nickel? And it gives you an unsurpassed view of New York Harbor and the great skyscrapers at the tip end of the island.

One of the big ocean liners is likely to be in port during the convention and arrangements can probably be made to visit it. You will also be welcome at the great New York Navy Yard in Brooklyn where the nation's biggest battleship, the "Mighty Mo" was built and launched.

Committee Chairman Gene McCauliff has set up a Special Activities Committee under Paul B. Slawter, Jr., Sterling Advertising Agency, 535 Fifth Ave. He will be glad to assist in arranging for theatre parties and visits to radio and television studios. A complete calendar of current events, concerts, shows and other entertainment can be obtained by writing to the New York Convention and Visitors Bureau, 500 Park Ave., New York 22, N.Y. But the most important thing to do is to decide now that you're not going to miss the big show in the Big Town on Wednesday and Thursday, May 20 and 21, 1953.

I.C.A.F.

By COL. PIERRE A. KLEFF, Cml.C.

PIERRE A. KLEFF
Colonel, CMLC, member of the Faculty Industrial College of the Armed Forces.

The other day, I met an old war-time buddy I hadn't seen since the summer of 1945. We were both so pleased in having accidentally met that we dropped in a club to renew our old friendship. He had spent his war years overseas in a Chemical Corps unit but after the war he went back to his "civvies" again. Now he's a Reserve Officer and has a mighty fine job as a chemical engineer with a large chemical company. We had a most interesting conversation and after a while we got around to what I'd been doing since 1945. In fact, what brought us around to discussing my own activities was his query, "Say, what does that 'I.C.A.F.' on your badge mean?" Now this question is not all unusual as I am quite frequently queried as to these initials "I.C.A.F."

These initials refer to the Industrial College of the Armed Forces. My old buddy seemed polite but somewhat incredulous. No, I'm not kidding—it really means the "Industrial College of the Armed Forces." No, we don't teach industrialists! No, it's not a trade school! Yes, it's for officers! No, it's not a reform school for officers! But suppose I tell you about it. That would be easier than just answering your questions.

First, what is the I.C.A.F.? As I said, it's the Industrial College of the Armed Forces. It is located at Fort Lesley J. McNair, Washington, D.C. The forerunner of the Industrial College of the Armed Forces was the Army Industrial College, established in 1924. In 1949 the Industrial College of the Armed Forces gave recognition to this important event by celebrating the twenty-fifth anniversary of the College.

The history of this College is most interesting in that it was established to fill an urgent need for officers with specialized training in industrial mobilization. The establishment of a college to provide such training was the result of a gradual realization among our military leaders that we were sadly lacking in this field. World War I had shown up our deficiencies in the mobilization of material and industrial organizations essential to our wartime needs. The first step forward to overcome this deficiency was a specific provision in the National Defense Act of 4 June 1920 for the lodgment of supervision for the procurement of military supplies for the Army in the Office of the Assistant Secretary of War. To implement the provisions of this Act, there was some talk—but merely talk—of establishing a school but, as usual, funds were not available for such a project. So early in 1921, the Assistant Secretary's office set up within its own organization a system of "apprenticeship training." This system was far from adequate and presented numerous problems, but it did provide a nucleus of trained officers.

In 1923, the Assistant Secretary had prepared an "Orientation Course of Reading" for Regular Army Officers and a "Procurement Manual" and "Instructions for Reserve Officers as to Procurement Plans" for Reserve Officers. But this training, even though it reached a larger number of officers, was still inadequate. As more and more people became interested in this subject it became quite evident that there was a requirement for the establishment of a school. Plans were prepared and the Army Industrial College came into being on 21 February 1924. The first class of nine officers graduated in June 1924. This represented an experiment in instruction as well as an experiment in the study of industrial mobilization and procurement.

The Army Industrial College became a joint institution in September, 1926, when the class was increased to 35 and a contingent of Navy and Marine officers was included. In 1930, a Navy Officer joined the faculty. By 1939, the class had increased to 62 officers and the curriculum and teaching methods had greatly improved. But the world situation was such in the fall of 1939 that the course had to be accelerated and adjusted to the war threat. After graduating the 1939-1940 class ahead of schedule, short courses of 4½ months, then 4, then 3-months duration were run. But the demand for officers qualified as instructors increased from other quarters and, in addition, it became increasingly difficult to keep abreast of the rapidly changing world situation. Then came the Japanese attack on Pearl Harbor, making it imperative that these key officers be returned promptly to active war duty status. So the fourth short course was terminated on 23 December 1941, and the Army Industrial College went into an inactive status on Christmas Eve 1941.

After approximately two years in this inactive status, the College was selected as the agency for training both military and civilian personnel in contract termination and renegotiation, which were anticipated as becoming tremendous tasks upon the conclusion of hostilities. Thus on 28 December 1943 the College was reactivated for this purpose, and more than 4,700 students were trained in this important field.

In the meantime, plans were formulated for reopening the College in its regular prewar status; and on 4 January 1946 an interim course of six months' duration began. On 11 April 1946 the Under Secretary of War and the Assistant Secretary of the Navy entered into an agreement regarding joint departmental participation in the activities of the College. On 26 April 1946, the College was redesignated the Industrial College of the Armed Forces. In September 1946 the first regular postwar course convened, and a regular schedule of one course per year has been maintained ever since.

On 3 September 1948, the Industrial College of the Armed Forces was reconstituted as a joint educational institution operating under the direction of the Joint Chiefs of Staff, and formal recognition of its status as being on the highest level of the educational field within the Department of Defense was accorded. This recognition of the equal importance of logistics and economic mobilization with tactics and strategy in planning for national defense marked a long stride forward in the progress of military education.

Just where does the Industrial College of the Armed Forces fit in the military educational system? Well, as you know, the young officer starts his military education by taking the basic course of his branch. In the Chemical Corps, this is a 13 weeks' course (9 weeks' basic and a 4 weeks' special smoke course) conducted by the Chemical Corps School, under the supervision of the Chemical Corps Training Command, at Fort McClellan, Alabama. The next step is the advanced course which is a ten months' course and where a five months' course is conducted. The next two Colleges are co-equal partners at the highest level in the military educational system within the Department of Defense. These two are the Industrial College of the Armed Forces and the National War College, both of which are located at Fort Lesley J. McNair.

What is the difference between the courses at these two top-level military colleges? The difference lies in the overall subject matter of the Colleges. The National War College pursues studies in global strategy; whereas, the subject matter of the Industrial College course is Economic Mobilization. In very general terms, it might be said that the National War College conducts a study of national and allied strategy and their four elements: political, economic, military and psychological, which is at times referred to as psycho-sociological.

Now the Industrial College of the Armed Forces operates under the direction of the Joint Chiefs of Staff according

Seminar on "Procurement Service Concepts," held at the Industrial College of the Armed Services.

Rear Admiral W. McL. Hague, USN, Commandant of the Industrial College of the Armed Forces, seated at his desk. With him in his office are (left) Brig. Gen. B. M. Hovey, representing USAF, and (right) Brig. Gen. Leonard J. Greeley, representing U.S. Army.

likewise conducted by the Chemical Corps School. Other than for certain special courses, after an officer has completed both the basic and advanced courses of his branch, he has completed his military education within his branch of service. The next step is a ten months' course at the Command and General Staff College at Fort Leavenworth, Kansas, which is under the direction of the Department of the Army. From here the officer matriculates to the Army War College at Carlisle Barracks, Pennsylvania, for another ten months' course under the direction of the Department of the Army. Again, other than for some special courses, when an officer graduates from the Army War College he has completed his military education within the Department of the Army. While the Army Officer is advancing through the educational system of the Department of the Army, his fellow officers in the Navy and Marines and in the Air Force are likewise progressing through their respective military educational systems. So the graduate of the Army War College meets his fellow graduates from the Naval War College at Newport, Rhode Island, and from the Air University at Maxwell Air Force Base, Montgomery, Alabama. Inasmuch as each of the officers has completed the military educational system within his own Department, he is now ready to enter the educational system under the direction of the Joint Chiefs of Staff. The Armed Forces Staff College at Norfolk, Virginia, is the first step, to the provisions of a Charter from the JCS. This Charter assigns the following mission to the College:

"To prepare selected officers of the Armed Forces for important command, staff, and planning assignments in the Department of Defense and to prepare selected civilians for important industrial mobilization planning assignments in any government agency, by:

"Conducting a course of study in all phases of our national economy and inter-relating the economic factors with political, military and psychological factors.

"Conducting a course of study in all aspects of joint logistic planning and the inter-relation of this planning to joint strategic planning and to the national policy planning.

"Conducting a course of study of peacetime and potential wartime governmental organizations and the most effective wartime controls."

Yes, this mission certainly is very broad. The Joint Chiefs of Staff, however, have scoped this mission as follows:

"Orientation in the broad aspects of world political, economic and power patterns.

"Study of the economic potential for war of the nations of the world and the blocs of nations which might have special significance in peace or war and analysis of the relationship of the economic potential to political, military and psychological factors in our national strategy.

"Study and analysis of the organization and administra-

tion of the Department of Defense and other governmental agencies concerned with mobilization of the national economy for war and later reconversion to a peacetime basis.

"Study of methods of formulation and means of implementation of joint logistic plans and the relation of these plans to joint strategic plans and to the economy of the Nation.

"Study of the production aspects of mobilization of the national economy and analysis of those factors vitally affecting the production program during mobilization and reconversion.

"Study of the procurement, production, and distribution aspects of mobilization for war and reconversion to a peacetime basis.

"Study and analysis of manpower problems in connection with mobilization of the economy and of mobilization of the military forces.

"Study of the relationship between technological progress and the mobilization of the national economy.

"Study and analysis of any phase of economic mobilization of the United States or foreign countries which is considered significant to the defense of the Nation."

The writer is a member of the faculty at the Industrial College of the Armed Forces. How do we teach such a complex subject as economic mobilization? Well, first of all, in my opinion, we do not teach in the strict sense of the word. Only occasionally do faculty members lecture to our own student body. We are more faculty advisors than teachers. The I.C.A.F. is a graduate school and thus our instruction is given on the graduate school level. Our principal means of instruction is by the lecture-seminar system. Lectures are delivered by outstanding visiting specialists from industry, labor, education, science, the military, and other government departments and agencies. These lectures are keyed to the various subjects indicated by the scope of the mission of the College. In these lectures, primary emphasis is placed upon a clear statement of the over-all problem, an analysis of the major conditions and controlling factors, an interpretation of past experience, present trends, and possible future developments. Following the lectures, there is a discussion period during which time there is free and open questioning of the lecturer and joint discussion of the topic presented.

In addition to the lectures given to the Industrial College of the Armed Forces, there are lectures sponsored by the National War College and some lectures sponsored jointly by both Colleges. Those sponsored jointly are, of course, attended by the students from both Colleges. And most of the lectures presented by the National War College are attended by the Industrial College students. Thus, through this integration of lectures, the Industrial College student receives a great deal of the instruction presented to the National War College.

Seminars are conducted in every subject and are intended to supplement the lectures and individual research work of the students. The seminar panel members are also specialists from industry, labor, education, science, the military, and other government departments and agencies. These seminars provide an opportunity for small, informal group discussions of subject matter relating to the study problem assigned. In addition to the valuable information gleaned from seminars, they provide the student with valuable experience in the extemporaneous presentation of ideas and the support of viewpoints, in the analysis of problems being discussed, and in the participation and conduct of discussion groups.

Interviews are another important source of information for our students, and Washington is an ideal location for the conduct of such interviews. Top government and military offices are located here as well as the branch offices of many industrial organizations. Washington is, therefore, rich in sources of information.

We also show a number of educational and industrial motion pictures. These are an integral part of the course and are shown in support of specific studies. They are usually short, lasting but approximately 30 minutes, and are selected for their content and minimum of advertising.

In addition to the lectures, seminars, interviews, etc., a number of ½-day or 1-day field trips are conducted in and around the Washington area. These are generally in support of specific studies. Visits may be made to government departments or agencies (e.g., The National Bureau of Standards), military installations (e.g., Aberdeen Proving Ground; Naval Gun Factory); research facilities (e.g., Naval Ordnance Research Laboratory); power plants (e.g., in Washington); civil defense organizations (e.g., in Baltimore); industrial facilities (e.g., in the Baltimore area); and the like. These are most beneficial to the students in that they provide a quick look into the actual functions and operations of organizations and facilities under study.

One of the highlights of the academic year is the annual one-week field trips to important industrial centers of the United States. These field trips usually come in May, near the end of the scholastic year, and provide the student with first-hand acquaintance with many industrial processes and problems, which cannot be obtained solely from textbooks and lectures. Thus, a more realistic approach to the problems of economic mobilization is obtained by this direct, down-to-earth contact with the operations of the industrial complex of the Nation. The students are provided an opportunity not only to examine industrial facilities and processes but also to discuss with company officials the many problems of economic mobilization which are of interest to industry as well as to the Armed Forces. Thus, while it is impossible to bring the industry to the lecture hall or seminar rooms, the field trips make it possible to take the student to the industry and thus conduct an on-the-scene seminar. These trips have proved of inestimable value in the past and will probably continue to do so. This year, in the first week of May, the students, in groups of 12 to 15, will visit the following eleven industrial areas:

Birmingham, Buffalo, Chicago, Cleveland-Akron, Detroit, Houston-Dallas, Los Angeles, Philadelphia, Pittsburgh, Springfield-Hartford, and St. Louis.

What subjects are included in the curriculum? There are 14 main areas of study in the curriculum. These, of course, are subdivided into the numerous supporting subjects. After an initial Orientation Unit, during which time administrative procedures are discussed and the students are introduced to the basic problems of economic mobilization. Following this introduction to the College, units in Manpower, Technological Progress and Natural Resources are presented. The Manpower Unit consists of a study and analysis of manpower logistics in connection with the mobilization of the national economy and the armed forces. The Technological Progress Unit consists of a study of scientific and technological resources in their relationships to the mobilization of the national economy and to the maximum development of the Nation's economic war potential. The Natural Resources Unit consists of a survey of selected natural and related resources of the United States and other nations essential for the maintenance of a war economy. Then a two-week period is devoted to the Executive Skills Unit, which is a study, analysis, and evaluation of the tangible and intangible elements, individual qualities and skills contributing to the effectiveness of an executive. Following these come instruction in the Requirements, Procurement, and Economic Stabilization Units. In the Requirements Unit is presented a study of the problems of determining military, civilian, and

foreign aid material requirements and the adjustment of these requirements to national productive capacity. The Procurement Unit presents a study of the procurement aspects of economic mobilization and subsequent reconversion and demobilization. The Economic Stabilization Unit consists of a survey of the methods and policies used to stabilize the national economy during a war or defense emergency.

These units of the over-all course in Economic Mobilization occupy approximately the first half of the collegiate year. The second half of the year commences with the Production Unit, then the Public Services, Economic Potential, and Distribution Logistics Units follow. The Production Unit is a study of the production phase of logistics; that is, a study of the production capabilities and limitations of the national economy in wartime; industrial conversion and expansion; the timely and effective utilization of industrial resources; and reconversion. The Public Services Unit consists of a study and analyses of the role of transportation, power, telecommunications and other services in the functioning of the national economy and of the problems involved in mobilizing these basic resources in the event of a national emergency. In the Economic Potential Unit, the students make a study, analysis, and evaluation of the economic potential for war of the United States and other selected nations; the economic position of major areas of the world; international economic relations; international programs; economic intelligence; and economic warfare. In the Distribution Logistics Unit, a study and analysis is made of the problems involved in the distribution and control of military equipment and supplies.

At the completion of these units of the curriculum, the students of the Industrial College, together with the students of the National War College, participate in the Joint Strategic Logistic Planning Unit. In this unit, integrated committees of students from both Colleges make a study and analysis of joint logistic planning and its relationship to joint strategic and national policy planning. This is a most beneficial two-week period in that it gives the "global strategist" and the "economic mobilization planner" an opportunity to get together on the same committee and thrash out problems of mutual interest on a "down-to-earth" basis.

The grand finale is the Mobilization Unit, in which a study and analysis of the problems and methods of economic mobilization and reconversion are considered in their entirety. This unit of the over-all course serves as a synthesis and evaluation of the basic elements, functions, and controls involved in the management of a war economy, as previously studied during the academic year. It pays particular attention to the military aspects of industrial mobilization for which the Armed Services, under the coordination of the Munitions Board, are responsible. It also considers the lessons learned from the mobilization experience of World Wars I and II, as well as those derived from a study of the plans and readiness measures developed by the responsible agencies in conformance with the provisions of the National Security Act of 1947 and subsequent security and emergency legislation.

Yes, only officers of the regular Army, Navy, Marine Corps, or Air Force, plus certain selected civilians, are eligible to attend this resident course, the "Economic Mobilization Course." But, I've only discussed the resident course because that's the one in which I am primarily involved. However, there are two other courses of instruction given under the supervision of the Industrial College. I mentioned the JCS Charter under which the College operates. Well, this Charter authorizes three courses of instruction:

"The regular course of instruction will be approximately ten months duration with classes commencing annually about 1 September. The College will also conduct courses for officers of the National Guard, Reserve Officers of the Army, Navy and Air Force and selected executives of industry, educators and prominent citizens. These courses will be based on the regular resident course and will consist of instruction either at the College or at cities throughout the country by members of the faculty of the College, and of correspondence courses."

The enrollment in each of these three courses is determined by the JCS in accordance with the following provisions of the Charter:

"The Joint Chiefs of Staff, acting on the recommendations of the Commandant, shall annually determine the total student enrollment, including that of the correspondence course in economic mobilization. Similarly, they shall allocate military student vacancies for the resident course to the Services, and civilian student vacancies to appropriate civilian governmental agencies and to the Department of Defense. Within the total enrollment prescribed by the Joint Chiefs of Staff the Commandant shall allocate student vacancies for the correspondence course in economic mobilization. Criteria for nominating civilian students in all courses shall be such that these nominees will be of a quality comparable to the corresponding military students. Admission of civilian students to all courses shall be by approval of the Commandant."

In order to comply with the Charter, the College presents its "Field Economic Mobilization Course" in major industrial centers throughout the country. This is a two-week condensed version of the ten-month resident course. Enrollment in this course is accomplished locally and not through the Industrial College. Reserve Officers apply through their official channels to the respective Army Area Commander, Naval District Commandant, or Air Force Commander in whose command the course is being given. Marine Reserve Officers apply to Headquarters, Marine Corps. Upon selection, Reserve Officers are ordered to active duty for the period of instruction. Civilian participants are selected by a locally appointed civilian committee. Civilians are selected so as to represent a cross-section of individuals engaged in industry, labor, education, science, and civic community life, who may reasonably be expected to fill key positions in those fields in the near future. The course is given under the supervision of one of the two CRIB (Civilian-Reserve Instruction Branch) teams. These teams travel around the country wherever they are invited and present their course. They have given as many as 18 such presentations in one academic year. This program was initiated in January, 1948, and 83 courses have been presented to people in 57 cities since then. The usual attendance is approximately 300 people per course, approximately half of whom are military. As of today, approximately twenty thousand individuals have graduated from this "Field Economic Mobilization Course."

The third course authorized by the Charter is the Correspondence Study Course entitled, "Emergency Management of the National Economy," which is presented by the Correspondence Study Branch of the College. This course was authorized by the JCS in January, 1949, and the first students were enrolled in September, 1950. This course is conducted by correspondence and is based on the curriculum of the ten-month resident course. The objective of this Correspondence Study Course is to offer the subject matter of the resident course to those qualified students who cannot attend the resident course and to provide graduates of the "Field Economic Mobilization Course" with additional material in the event they wish to continue their study of economic mobilization. Regular, Reserve, and National Guard officers, as well as civilians, are enrolled in this course. Enrollment is through channels for the military and direct to the Commandant of the College for civilians. At the present time there are approximately 2,300 students enrolled in this course and over 1,700 have graduated.

We do not have an unnecessarily complicated organization to accomplish our mission and present these three separate

courses of instruction. In fact, our organization is fairly simple. The College is headed by a Commandant and two Deputy Commandants, one from each of the three services. Rotation of these three offices is made from time to time, as directed by the Joint Chiefs of Staff, in such a manner as to insure that the Army, Navy, and Air Force are always represented. Our staff and faculty is likewise jointly manned as it is composed of approximately equal Army, Navy and Air Force officers plus some civilian members who are specialists in various aspects of economic mobilization.

The Marine Corps is well represented, too. We have several Marines on our faculty. And it might be interesting to note that the College has had a Marine Corps Commandant, Colonel Frank Whitehead, USMC, who was the Commandant from 1 February 1941 to 1 January 1942.

Today, our Commandant is Rear Admiral W. McL. Hague, USN, and the two Deputy Commandants are Brigadier General Burton M. Hovey, USAF, and Brigadier General Leonard J. Greeley, USA. One of the Deputy Commandants, Brigadier General Greeley, supervises the operations of the Education Division, which plans, develops, and executes the resident course. Within the Education Division there are six Branches, namely, Economic Potential, Manpower, Mobilization, Procurement, Production, and Requirements. These Branches present the 14 units which comprise the Economic Mobilization Course. The other Deputy Commandant, Brigadier General Hovey, supervises the operations of the Extension Courses Division. Within the Extension Courses Division there are two Branches, the Civilian Reserve Instruction Branch, which presents and administers the Field Economic Mobilization Course, and the Correspondence Study Branch, which presents and administers the Correspondence Study Course.

Then there's the usual Executive Office with its administrative and security personnel; also the library. In addition we have a Special Staff, a small group of one officer and several civilians, which acts in the capacity of special advisor to the Commandant.

This is the so-called "chart" organization. But in addition to this there are four councils or boards which assist the Commandant in carrying out his task. These are the Board of Advisers, the Policy Council, the Faculty Board, and the Staff Advisory Council.

The Board of Advisers to the Industrial College of the Armed Forces consists of prominent civilians and government officials. They are appointed by the Commandant and have individually and collectively accepted the responsibility of providing the Commandant with professional, scientific, and technical counsel on matters relating to the mission of the College. For over twenty years, this Board, composed of outstanding Americans from the fields of government, industry, commerce, finance, labor, education, science, and the learned professions, has considered the College curriculum, advising the Commandants and faculty on the ever-changing requirements of economic preparedness, the latest technological developments in industry, the advances in science and education, and the economic health of the Nation. This service has proved of inestimable value, and the College curriculum reflects, to a considerable extent, the wisdom of these Advisers. This Board has organized itself with a regular chairman, and the College has provided it with a senior member of the College Staff as its Secretary. Meetings of this Board of Advisers with the Commandant and senior staff members of the College are held regularly.

The Policy Council is composed of the Commandant and the two Deputy Commandants. The Executive Officer attends all meetings as Recorder. The Chief, Special Staff, and other members of the Staff and Faculty are invited to attend when representation from them is deemed desirable. The Council meets from time to time for the disposal of appropriate policy matters.

The Faculty Board is composed of the Deputy Commandant responsible for the resident course, the Education Division Branch Chiefs and the Director of Instruction, who serves as registrar. This Board makes recommendations on all matters relative to the proficiency or deficiency of all resident students and acts upon such other matters relative to the College as may be referred to it.

The Staff Advisory Council (STAC) is appointed twice yearly by the Commandant for the purpose of considering new ideas and important problems affecting College policy by utilizing more fully and effectively the special knowledge and abilities of all individuals within the College and by providing an opportunity for the full expression of such opinion. This Council is composed of seven members, both military and civilian, with representatives from the Office of the Commandant, both Divisions of the College, and the Executive Office. The members serve as individuals and not as representatives of any organization or group. This Council meets monthly or more often as required. It establishes its own organization, elects its own chairman, and determines its own procedures. It acts solely as an advisory body and makes its recommendations to the Commandant.

Yes, we are completely unified here at the Industrial College. Yes, this unification applies to the student body as well as to the Staff and Faculty. For example, in this year's class, there are 42 Army Officers, 34 Navy Officers, 6 Marine Corps Officers, 42 Air Force Officers, and 9 civilians from the various government departments. The average student has twenty years' experience and is 43 years of age. He has been carefully selected by his military or civilian government department. Army Officers must: have from 18 to 25 years' service; be chosen from the most highly qualified officers otherwise eligible; have indicated by actual performance of duty a potentiality for high command and staff position; be physically qualified for general service; and have credit for the Armed Forces Staff College, or be graduates of the Army War College, the Air War College, or the senior course at the Naval War College, or have credit for phases A, B, and C of the Industrial Mobilization Training Program. Naval and Marine Corps Officers are eligible for selection for attendance at this course if they are captains or commanders (or the USMC equivalents) with approximately 18 to 26 years' service. The Air Force requirements for selection are that the student be a permanent colonel or lieutenant colonel with not more than 20 years' promotion list service. Civilian students are assigned only from government departments or agencies. The average civilian student possesses formal education at the graduate level, wide administrative and professional experience in the field of national security, and personal characteristics and intelligence which qualify him for highly responsible duty in the event of a national emergency. These students are completely intermingled in their study groups and student committees. Thus, by the time the student graduates, he is completely unified and is capable of wearing any one of five hats or all five at one time!

What happens to graduates? This is a rather difficult question to answer. Many of them go to the Joint Chiefs of Staff, the Munitions Board, joint overseas staffs, and to the headquarters of their own Departments. Others return to their Departments in varying capacities. Most of the civilians return to the government agencies which sent them to the College and it is not at all unusual for them to obtain promotions shortly after their return. Those within the military who are due for overseas service or sea duty receive such duty, which may be with a joint staff or which may be strictly within the officers' own Department.

The most distinguished of our graduates is President Dwight D. Eisenhower, of the Class of 1933. There have been many others of considerable fame and prestige, too, including:

General of the Air Forces, H. H. Arnold, February, 1925;
Maj. Gen. Jerry V. Matejka, USA, June, 1926;
Lt. Gen. Thomas B. Larkin, USA, 1927;
Rear Adm. Morton L. Ring, USN, 1930;
Maj. Gen. Innis P. Swift, USA, 1931;
Maj. Gen. Elbert L. Ford, USA, 1932;
Lt. Gen. John C. H. Lee, USA, 1933;
Vice Adm. John D. Price, USN, 1933;
Vice Adm. W. S. Farber, USN, 1933;
Gen. Clifton B. Cates, USMC, 1933;
Maj. Gen. Eugene M. Foster, USA, 1934;
Lt. Gen. Barton K. Yount, USAF, 1935;
Maj. Gen. A. W. Vanaman, USAF, 1936;
Gen. Muir S. Fairchild, USAF, 1936;
Vice Adm. E. D. Foster, USN, 1937;
Maj. Gen. Richard C. Coupland, USAF, 1937;
General J. Lawton Collins, USA, 1937;
Vice Adm. A. G. Robinson, USN, 1939;
Maj. Gen. William F. Dean, USA, 1939;
Lt. Gen. W. D. Styer, USA, 1940;
Lt. Gen. H. S. Aurand, USA, 1940;
Maj. Gen. Orlando C. Mood, USA, 1940;
Maj. Gen. Herman Feldman, USA, 1940; and
Maj. Gen. Jonathan P. Holman, USA, 1940.

These are only a few of the many distinguished graduates of the Industrial College whose pictures grace the halls of the College. But perhaps it might interest you to know the many and distinguished Chemical Corps graduates. The list is headed by two former chiefs of the Chemical Corps:

Maj. Gen. W. C. Baker, June, 1925; and
Maj. Gen. W. N. Porter, January, 1926.

The present Chief of the Chemical Corps, Maj. Gen. E. F. Bullene, is a graduate of the Class of 1928. The list includes eight Brigadier Generals:

H. M. Black, 1927;
G. M. Halloran, 1927;
E. C. Wallington, 1928;
J. F. Battley, 1933;
R. L. Avery, 1935;
R. H. Tate, 1938;
C. E. Loucks, 1940; and
L. J. Greeley, 1948.

Chemical Corps officers who are graduates and are still on active duty are currently assigned as follows:

Maj. Gen. E. F. Bullene, 1928; Chief, CmlC;
Brig. Gen. Charles E. Loucks, 1940; Deputy Chief, CmlC;
Brig. Gen. Henry M. Black, 1927; CG, Materiel Command, CmlC;
Brig. Gen. Leonard J. Greeley, 1948; Deputy Commandant, ICAF;
Col. Hugh W. Rowan, June, 1925; Chief, PTI Div., OC CmlC;
Col. Ralph C. Benner, 1940; Pres. Chemical Corps Board;
Col. Norman D. Gillet, 1938; Chief, Personnel Div., OC CmlC;
Col. Sterling E. Whitesides, Jr., 1937; CmlO, 6th Army;
Col. Robert D. McLeod, Jr., 1946; CmlO, 3rd Army;
Col. Leonard M. Johnson, 1940; Member, Chemical Corps Board;
Col. Thomas H. James, 1947; CmlO, U. S. Army Europe;
Col. Ralph B. Strader, 1950; Office, J.C.S.;
Col. Richard R. Danek, 1948; Deputy Commander, CmlC Training Comd.;
Col. William E. R. Sullivan, 1949; Res. & Eng. Coordinator, Res. & Eng. Command;
Col. Donald D. Bode, 1947; Member, Safety Advisory Group, Japan;
Col. Harold Walmsley, 1949; Deputy Cdr., Materiel Command, CmlC;
Col. John D. Tolman, 1951; C.O., Deseret Chemical Depot;
Col. James E. McHugh, 1947; Deputy Chief, Cml. Div., U.S. Army, Europe;
Col. George W. Dorn, Dec. 1941; C.O., San Francisco, Cml. Proc. District;
Col. Pierre A. Kleff, 1950; Faculty, ICAF;
Col. Gilbert P. Gibbons, 1952; Comptroller, CmlC Materiel Command;
Col. Graydon C. Essman, 1953; Student, ICAF;
Col. Adam W. Meetze, 1948; C.O., Rocky Mountain Arsenal;
Col. Nelson I. Decker, 1947; Chemical O, VI Corps;
Col. James H. Batte, 1947; Chief, Overseas Liaison Office, O.C. CmlC;
Lt. Col. Jack E. Babcock, 1946; Member, U. S. Element, Allied Forces, Southern Europe;
Lt. Col. Timothy C. Williams, 1948; Exec. O., Pine Bluff Arsenal; and
Lt. Col. Arthur H. Williams, Jr., Dec. 1941; Office, Asst. Sec. of the Army.

That will give you some idea of what happens to the graduates of the Industrial College. Some reach fame and distinction while others rise to great heights within their own Service. But all contribute greatly to the defense of this Nation, both in war and in peace.

We feel that the Industrial College of the Armed Forces is performing a very important mission in the national defense effort. The College is an essential component of the educational system of the Department of Defense. Its establishment came largely through the cooperative efforts of the Technical Services of the Army, followed very closely by the Bureaus of the Navy. Instruction has therefore been closely geared to the requirements of these Services and Bureaus. However, with the passing years, the curriculum has been expanded to a study of economic mobilization, but always keeping in mind the requirements of the Technical Services and Bureaus. These officers, trained in the subjects previously enumerated, are of inestimable value when they return to their respective Services. Their experience at the College in working with their fellow officers in the other military Services, with civilian representatives from other government agencies, and with outstanding leaders from industry, labor, education, and science, cannot help but vastly increase their value to their own Service upon their return. These officers, with their expanded knowledge and appreciation of economic mobilization and national defense are a great asset to the military establishment. The value of their understanding and appreciation of the importance of a strong civilian-military team for national security, both in peace and in war, cannot be underestimated. The military has made, and will continue to make, maximum use of these graduates in many and varied important command, staff, and planning assignments. This is well illustrated by the statement made by General Eisenhower when he addressed the graduates of the Class of 1949, "During the war, whenever there was a decision as to the selection of a senior staff officer, and particularly in the logistic phases of the staff, I frequently ran into the question: 'Is he a graduate of the Industrial College?' "

The military is not the only beneficiary of the courses of instruction at the Industrial College of the Armed Forces. The civilian graduates of the resident course return to their respective government agencies with a much better knowledge and appreciation of economic mobilization and the role of the civilian-military team in the execution of national security. Those who visit the College as lecturers and seminar panel members leave with a much clearer vision of the valuable task being performed at the College. Their many expressions of appreciation, for having been given the opportunity to participate in discussions with the College group,

attest to the fact that these leaders from the civilian membership of the civilian-military team are keenly aware of the importance to the security of this Nation of a group of military and civilian personnel, trained in all phases of economic mobilization.

The interest with which the CRIB team presentations are received, and the lively character of their discussion periods, are evidences of the realization on the part of community leaders of the necessity for having key individuals acquainted with the many aspects of economic mobilization. The twenty thousand graduates of this Field Economic Mobilization Course are an added strength to the sinews of this Nation in preparing itself against all aggressors.

To these thousands must be added the hundreds which have graduated and will continue to graduate from the Correspondence Course. Many of these are graduates of the Field Economic Mobilization Course who have a strong desire to pursue their studies further. All are interested in better preparing themselves in this complex subject of economic mobilization.

All of this added together means that there is an ever-increasing number of Americans coming to the realization that, for the continued security of this Nation, we must have more and yet more key individuals trained in the fundamentals of economic mobilization. Both sides of the civilian-military team benefit. There is a better understanding on the part of the military of the complexity of the problems on the civilian side of government and industry. And the civilian members of the team obtain a clearer vision of the magnitude of the task involved in mobilizing our economy and in maintaining our national security. Everyone benefits, not only those directly in contact with these courses, but also the Nation as a whole, because of the availability of these key individuals trained in the fundamentals of economic mobilization. This then has been the goal and the achievement of the Industrial College of the Armed Forces in carrying out the provisions of its Charter.

Well, it was a most interesting conversation. My friend and I both enjoyed it. In fact, he is so interested in those initials, "I.C.A.F.", that he intends to enroll in the Correspondence Course and learn a great deal more about economic mobilization!

BIG SAVINGS

Army Chemical Corps maintenance teams have saved the American taxpayer more than $432,000 by rebuilding and modernizing 18 World War II field impregnation plants. Used by the Army to gas-proof combat uniforms and equipment in event of a poison gas attack, a new unit bought today would cost $61,800. The World War II models were rebuilt at a cost of $37,800 each. Intended to serve as mobile impregnation plants, the units have served as field laundries in Korea.

WAR GAS USES

Chlorpicrin, a poison gas first used by the Russians in World War I, is also useful as a fertilizer. Experiments at the Army Chemical Center, Md., show that soils treated with chlorpicrin will yield better crops, especially grains and sugar beets.

FLAMES HELP FARMERS

The farm implement known as the flame cultivator, which traces its development to the Army Chemical Corps' World War II portable flamethrower, originally was designed to weed cotton but was adapted for other types of row-planted vegetation. Other civilian uses of the flamethrower are for clearing weeds from highway shoulders and railway beds, as well as destroying alligator grass and water hyacinths which impede river navigation.

THE HISTORICAL CORNER

By BROOKS E. KLEBER*

SOME UNSUNG HEROES

During World War II the CWS had its share of unsung heroes. The spotlight of publicity usually fell on the combat element of chemical troops—the chemical mortar battalions and the smoke generator companies. That they richly deserved the acclaim they received goes without saying. However, a large segment of chemical troops, the service units, performed duties which, if less spectacular, were equally as important.

The primary mission of some of these units, for example the chemical decontamination and chemical processing companies, was intimately connected with gas warfare. In a gasless war these companies (in addition to some work concerning their primary mission) performed secondary missions utilizing their skills and equipment. They also worked at jobs which had no relationship to their equipment or training. Let us consider one of these units, the 102d Chemical Processing Company. (The original designation of this type of unit was "chemical impregnating company.")

The 102d, stationed in India, performed a variety of activities. It impregnated clothing in the regular manner as a protection against the possible use of gas; it treated clothing with insecticides as a protection against disease. The company dry cleaned clothing and blankets. These were duties which entailed the use of their normal equipment and for which the unit had been trained. There were, however, other jobs to do.

Platoons and detachments of the company constructed their own processing plants, built water towers and installed water purification systems, assembled a small laboratory and tested water supply, and conducted tests in malaria control. They checked and repaired gas masks, renovated 4.2" mortar ammunition, served as railroad guards for toxic and other supplies, and furnished convoy drivers (some of whom became casualties) for the Ledo Road. For the most part there was little glory or headlines with all this—only hard, necessary work.

The Historical Office's files on these various service units vary as to their completeness. Although the records of the 102d Chemical Processing Company are quite adequate there is a paucity of material for many other units.

Are there among the readers any former members of the 98th Chemical Service Company or the 108th Chemical Processing Company who can supply the Historical Office with information—informal histories, personal recollections, or the like—on the overseas activities of these units?

* Member of the Staff, Historical Office, office of the Chief Chemical Officer.

MILLIONS OF MASKS

More than 35,000,000 (M) gas masks were procured and distributed by the Army Chemical Corps to military and civilian personnel during World War II.

CROP DUSTING

Today's modern method of dusting agricultural crops by low-flying airplanes is the result of the Army Chemical Corp's development of using airplanes to lay smoke screens in the 1920's.

Chemical Corps Reorganizing Procurement Program

Aimed at greater economy and increased efficiency, the Chemical Corps is undertaking a five-point reorganization that will streamline its procurement program and effect a minimum financial saving estimated at $300,000 annually when completed. The project will effect a saving in personnel commensurate with the expected reduction of the Corps' 1954 procurement program.

As announced by Major General E. F. Bullene, Chief Chemical Officer for the Department of Army, the project includes these five points:

1—The Boston Chemical Procurement District, although turning over its contractual responsibility to the New York Chemical Procurement District, will remain operative as an industrial contact point. The Boston office, located at the Boston Army Base, will continue to assist New England area firms, especially small business concerns, in bidding on items under procurement by the Chemical Corps. It will have copies of all drawings, specifications, and other information needed by prospective bidders for submitting bids on any item being purchased by the Corps.

2—The Chemical Corps Procurement Agency, located at the Army Chemical Center, Md., which is engaged principally in research and development type contracting will be transferred from the jurisdiction of the Chemical Corps Materiel Command to the Research and Engineering Command. The industrial type of procurement formerly performed by the Chemical Corps Procurement Agency will be assumed by the New York district.

3—The Chicago Chemical Procurement District will become a supporting agency for the Corps' Rocky Mountain Arsenal at Denver, Colorado.

4—The Dallas Chemical Procurement District will become a supporting agency for the Corps' Pine Bluff Arsenal at Pine Bluff, Arkansas.

5—The San Francisco and Atlanta Chemical Procurement Districts, as well as the Boston office, will remain open and in such a position that they can assume a full contracting work load in case of any sudden expansion of the procurement program. For the time being, the San Francisco and Atlanta offices will confine their operations to mobilization procurement planning, serving as contact offices for industry representatives, and carrying out inspection activities for contracts let to manufacturers in their geographical areas.

The major change will be the consolidation of the Boston contractual offices, including the legal staff that must be present, with those of the New York district and resulting in a subsequent saving in manpower and funds. This consolidation will be effected gradually during the rest of the calendar year. As each of the present Boston contracts is completed, the records and files will be transferred to the New York office. No new contracts will be let by the Boston district during this period, the New York district assuming responsibility for all new contracts made to the New England area.

The entire project will place a greater responsibility on the New York office, since it will result in a centralizing of all end-item procurement in that office. This appears to be the best procedure under the present limited emergency procurement program because of the highly specialized nature of the items being procured by the Corps. Should mobilization requirements call for an expanded procurement program in the future, the district offices will be in a position to again assume the responsibility necessary for the handling of contracts in their respective areas, thus automatically decentralizing the program under expanded procurement requirements. All six offices (Atlanta, Chicago, Dallas, San Francisco, Boston and New York) will continue to retain full bidding information for all items being procured by the Corps for the use of prospective bidders, thus saving the businessman from having to contact the New York headquarters except for submitting the final bid. This bidding information will include the component parts being purchased for the Corps' arsenals, as well as all end items.

As a result of the transfer of the Chemical Corps Procurement Agency at the Army Chemical Center, the New York district will assume the procurement support responsibility for manufacturing components required by Edgewood Arsenal which is located at the Chemical Center, while the Chemical Corps Research and Engineering Command (also located at the Chemical Center) will gain a new operating agency. This new agency will deal in contracts related to the Corps' research and development program and for support of the Army Chemical Center installation.

The reorganization will result in the Dallas Chemical Procurement District (which has been handling the procurement for both Rocky Mountain and Pine Bluff Arsenals) awarding contracts only for the procurement of component parts for the items being produced at Pine Bluff Arsenal, while the Chicago office will do the same for Rocky Mountain Arsenal. The two offices (Chicago and Dallas) will also carry on their mobilization planning operations and such area responsibilities as are necessitated in the interests of maximum economy.

The reorganization will result in a major improvement of the Corps' procurement activities, especially for the support of the manufacturing arsenals operated under the Army Industrial Fund, which is already effecting considerable savings for the government.

Since all of the Corps' seven procurement offices will remain in operation in one form or another, there will be adeouate facilities to handle all mobilization requirements as presently known and a geographical flexibility will be maintained in order to permit rapid changes in procurement assignments in event of mobilization.

For mobilization procurement planning purposes, and up to now also for general Chemical Corps procurement, the nation was divided into six geographical areas, as follows:

1—Boston Chemical Procurement District:

Maine, New Hampshire, Vermont, Connecticut, Rhode Island and Massachusetts. (This area will now be consolidated with the New York District for contract awards.)

2—New York Chemical Procurement District:

Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, Virginia and New York.

3—Atlanta Chemical Procurement District:

North Carolina, South Carolina, Tennessee, Mississippi, Alabama, Florida and Georgia.

4—Chicago Chemical Procurement District:

Kansas, Missouri, Nebraska, North Dakota, South Dakota, Minnesota, Wisconsin, Michigan, Ohio, Indiana and Illinois.

5—Dallas Chemical Procurement District:

Louisiana, Arkansas, Oklahoma, Colorado, New Mexico and Texas.

6—San Francisco Chemical Procurement District:

Montana, Wyoming, Idaho, Washington, Oregon, Nevada, Utah, Arizona and California.

ACETYLENE

(Continued from page 15)

going full commercial development, frequently by means of cooperative programs with other companies and various government agencies (Fig. 2). The following is a brief account of the present status of these materials in GAF's development program:

(XIII) Alkyl Vinyl Ethers

These materials are presently under study as monomers and intermediates for the production of a wide variety of polymers, copolymers and other chemicals for various uses. Ethyl vinyl ether shows decided promise as an anesthetic since it is less irritating, less nauseating than ethyl ether and generally reduces the danger of pneumonia.

(XIV) Vinyl Esters

These materials are currently under study at the Eastern Regional Research Laboratory and at many other organizations for use as monomers for polymers and copolymers useful in the manufacture of plastics, waxes, coatings, chewing gum bases, plasticizers, etc.

(XV) Polyvinyl Alkyl Ethers

An infinite number of these compounds can be made by varying the alkyl radical and the chain length. An example of this type of compound is polyvinyl methyl ether. This material is presently used for (1) the heat sensitization of latices whereby the application of slight heat causes latex to coagulate in the presence of PVM, a promising application in the production of heavy industrial rubber goods, (2) a binding agent for laminates, (3) a protective colloid for various coating and adhesive formulations, (4) the improvement of rewettable adhesives and hot-melt pick-up cements, among other uses. Another example of this type of compound is polyvinyl isobutyl ether (PVI) which is presently under study as a tackifier and adhesive for tape and other products.

(XVI) Alkyl Vinyl Ether-Maleic Anhydride Copolymers

(XVII) Derivatives of above such as substituted esters and amides.

Both of the above materials are currently under extensive study for use as textile sizes, soil conditioners, leather treating agents, thickening agents, film formers in cosmetics, etc.

(XVIII) Polyalkoxyacetals

These materials (masked aldehydes) are being studied for use as high boiling solvents, intermediates and for modification of phenolic resins. Very promising results are in evidence so far.

(XIX) Polyalkoxyalcohols

These products are currently under study as intermediates, components of hydraulic fluids, instrument fluids and lubricating oils. Early results are promising.

(XX) Chloroacetals

This group of materials is currently being used in the production of sulfathiazole and various essential oils.

(XXI) Malonaldehyde tetraalkylacetal

This material is of interest for the hardening of gelatin and in various condensation reactions involving a straight chain masked dialdehyde.

Special Reactions and Products

Certain other reactions involving the use of acetylene are shown in Fig. 3. The development status of these GAF products is as follows:

(XXII) Koresin

This material was originally produced as a tackifier of synthetic rubber. It is now used for modifying the tack and flow characteristics of other materials.

(XXIII) Cyclooctatetraene

This compound is of potential interest for the production of suberic acid and other chemicals.

(XXIV) Vinylcarbazole

Used as a dielectric in the production of small, very efficient electrical condensers.

(XXV) Polectron

This material is often referred to as a mica substitute. It was used during World War II in the construction of the proximity fuse.

REFERENCES

Copenhaver and Bigelow: "Acetylene and Carbon Monoxide Chemistry," Rheinhold Publishing Co., New York, (1949).

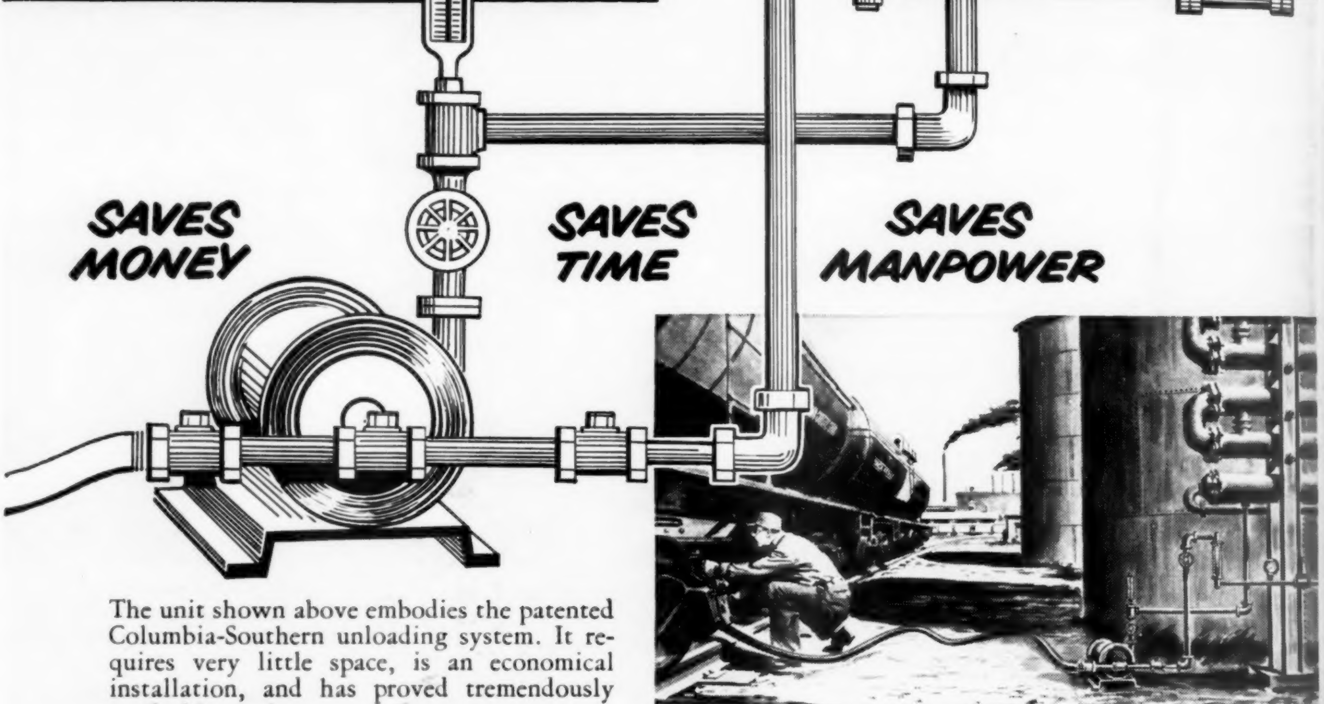
Craig, L. E.: Chemical Reviews, *Vol. 49*, No. 1-pp. 103-236.

"High Pressure Acetylene Derivatives," GAF Bulletin M104, General Aniline & Film Corp., New York, (1953).

"The Acetylene Industry and Acetylene Chemistry in Germany During the Period 1939-1945., BIOS Report, His Majesty's Stationery Office, London (1951).

Reppe, J. W., "Acetylene Chemistry" PB Report No. 18852-S, U. S. Dept. of Commerce New York: Chas. A. Meyer & Co., Inc. (1949).

THIS PATENTED COLUMBIA-SOUTHERN UNLOADING METHOD IS NOW AVAILABLE TO ALL CAUSTIC SODA USERS



The unit shown above embodies the patented Columbia-Southern unloading system. It requires very little space, is an economical installation, and has proved tremendously profitable to the user.

This unloading method was designed by Columbia-Southern's technical staff and engineers in answer to the dire need of consumers for a simple, efficient system that would dilute 73% caustic soda to a 50% concentration before storage with quality maintained.

This patented method incorporates unloading and diluting in one continuous operation. It has proved so successful that Columbia-Southern is now making it available—royalty free—to all users of caustic soda.

Columbia-Southern has much data attesting to the substantial savings made possible in money, time and labor by switching from 50% to 73% and utilizing this patented method.

Columbia-Southern's Technical Staff will be glad to make recommendations on the placement of this unit, and they will be glad to help you with the installation of it as well as assist you with the unloading of your initial 73% shipment.

Contact our Pittsburgh office now for further information.

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